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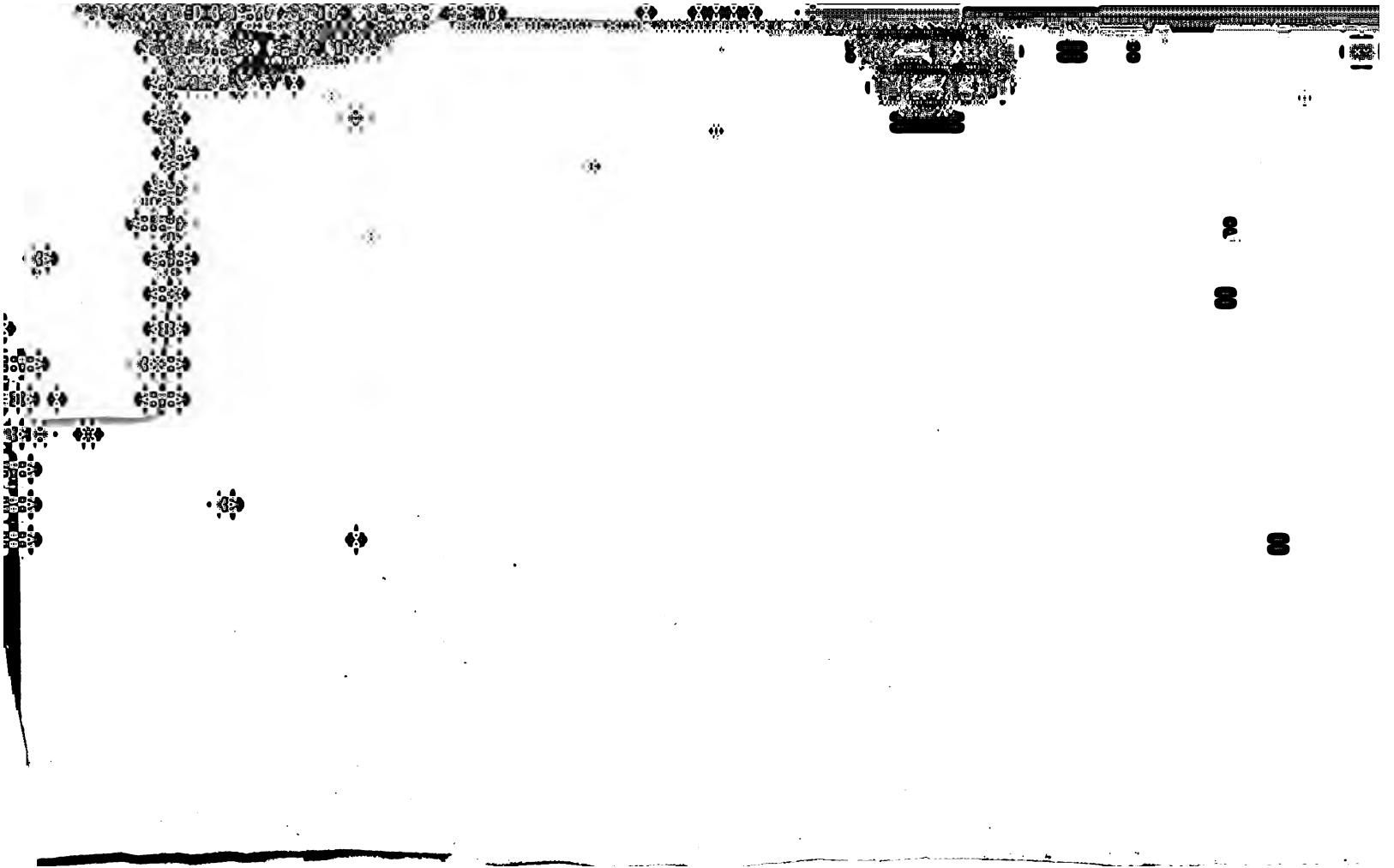

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THE CHEMIST;

OR,

REPORTER OF DISCOVERIES AND IMPROVEMENTS

IN

ANALYTICAL, MANUFACTURING, AND AGRICULTURAL

CHEMISTRY.

EDITED BY JOHN HIGGS NEWTON.

VOL. VII.

LONDON:
GEORGE PEIRCE, 310, STRAND.
1846.

PEIRCE, PRINTER, 310, STRAND.

INTRODUCTION

TO THE SEVENTH VOLUME.

SEVEN years have now elapsed since the publication of the first number of "THE CHEMIST," and, during the whole of that period, it can boast of the constant and steady support of its subscribers, notwithstanding the establishment of rival publications, which have sprung up in the interim, and endeavoured, in some cases with all the recklessness by which modern competition is so strongly marked, to outbid it in public favour.

Grateful are we to our readers for the continued confidence they have conceded to us; and we promise, that in following out the course we have traced for ourselves, no pains or diligence shall be spared to keep pace with the vast progress of chemical and philosophical knowledge, by taking the earliest notice of such new discoveries as those for which the present age has been so highly distinguished from every former period of an equal number of years. At the same time, our pages shall always be open to such of our correspondents as may have new or interesting subjects to describe.

How rapidly has one new fact succeeded another, each more pregnant with knowledge than its predecessor, and more likely to be serviceable to mankind; for the vulgar error that chemistry and philosophy possess no common interest with the world in general is now almost exploded. To whom at the present day does the manufacturer apply for advice as to the preparation of his material, whether

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intended for textile fabrics, or for works in metal or glass? The engineer, also, seeks his assistance to ascertain the laws by which the elastic force of steam is regulated. Again, agriculture is indebted for most of its modern improvements to the scientific knowledge imparted by the Chemist.

The fact of the vast importance of this science in the onward progress of human civilization, is becoming every day more apparent; and the universality and simplicity of the laws by which the universe is sustained, are more clearly evinced by the result of the laborious researches of the Chemist.

Unfortunately, until within these very few years, England was almost unprovided with schools in which this science could be deeply and advantageously studied; happily, this omission is now partly rectified, and we have lately seen the foundation of several Colleges of Chemistry, which bid fair, in a short time, to compete with the older establishments of the Continent.

One great element of success in every undertaking of our countrymen, is the fact, that, although they may at times be slow in commencing a good work, when once they have fairly began it, their exertions are seldom relaxed until every competitor is distanced; and we have no fear that the newly-established colleges will be an exception to this rule.

In watching the progress of these institutions, we shall not fail to give every publicity to their proceedings that our pages can afford, and to this end we are always ready to insert any well authenticated communications on the subject.

THE CHEMIST.

I. CHEMISTRY.

REPORT ON AN ESSAY BY M. FREMY, ENTITLED, RESEARCHES ON A NEW SERIES OF ACIDS FORMED OF OXYGEN, SULPHUR, HYDROGEN AND NITROGEN.*

WHILE examining, during his experiments on the metallic acids, the principal properties of a new class of salts, to which he has given the name of osmites; the author discovered that the osmites, when subjected to the action of sulphurous acid, or of the sulphites, produced a double acid, which contains the elements of osmious and sulphurous acid, and in which the fundamental properties of these acids are concealed.

Guided by this observation, M. Frémy endeavored to produce double acids resembling the preceding, by substituting nitrous for osmious acid, which possesses a marked analogy with it.

The results to which he was led are very important; we are about to notice them.

When you pass sulphurous gas through a concentrated alkaline solution of nitrate of potash, you produce, successively, four new salts, very easily distinguished, which are deposited in crystals the instant they are formed, and which are separated without difficulty.

The first, which the author calls sulphazite of potash, is extremely alkaline, very soluble, and crystallises like grape-sugar.

The second, which he calls sulphazate, is less easily soluble, and less alkaline than the former, and crystallises in beautiful needles like sulphocyanuret of potassium.

The third, still less alkaline and soluble than the second, crystallises in beautiful rhombohedrons; it has received the name of sulphazotate. The excess of alkali may be removed by a current of carbonic acid, and the salt then becomes but little soluble.

The fourth, neutral, and almost totally insoluble in water, crystallises in silky needles, like sulphate of lime; it is called sulphammonate.

The three first are so composed that each of them may be represented by—

1 equivalent of nitrous acid AzO^3
3 equivalents of water .. 3HO
3 equivalents of potash .. 3KO

by adding—

To the first, 3 equivalents of sulphurous acid, $3SO^2$.

To the second, 4 equivalents of sulphurous acid, $4SO^2$.

To the third, 5 equivalents of sulphurous acid, $5SO^2$.

Whence it follows, that for the same quantities of nitrous acid, water, and potash, the proportion of sulphurous acid may be as 3, 4 and 5.

The fourth salt, that produced in the last instance, would contain like the others—

1 equivalent of nitrous acid .. AzO^3
3 equivalents of water 3HO

but it would contain, also—

8 equivalents of sulphurous acid $8SO^2$
4 equivalents of potash 4KO

Are these elements grouped, as we here imagine them to be for the sake of distinctness, or is it rather merely an acid formed of sulphur, oxygen, hydrogen, and nitrogen? We will discuss this presently, after having examined the principal properties of the salts.

In any case the names the author has employed cannot become the object of fair criticism; he does not disguise this, and it was on account of the difficulty of finding others more suitable, that he admitted them, at least provisionally.

A question presents itself at the very outset: since the preceding salts contain 3, 4, 5 and 8 equivalents of sulphurous acid, may it not be possible there may be others that contain 1, 2, 5, and 6 equivalents of sulphurous acid, and perhaps even more than 8; in such a manner that the series of equivalent acids shall not be interrupted, and may form an arithmetical progression, the difference between the two terms of which would be unity?

This observation has not escaped the notice of the author; it will be the object of his future experiments.

* *Comptes Rendus.*

Independently of these four new salts, containing four new acids, the author has discovered five others, the acids of all of which are also new, and belong to the same family as the preceding.

Their formation is easily understood; let us explain it in a few words.

If we treat sulphazotate of potash, that which contains 5 equivalents of sulphurous acid for 1 of nitrous acid, 3 of water, 3 of potash, with water at from 104° to 122° it will lose 2 equivalents of sesquisulphate of potash, and form a salt which the author names sulphazidate, represented by the formula—

$$S^2O + H^3O^3 + AzO^3 + KO.$$

If we treat in the same manner the sulphammonate of potash, that which contains 8 equivalents of sulphurous acid and 1 of nitrous acid, 3 of water and 4 of potash, it will, in the first instance, give up to the water 1 equivalent of bisulphate of potash to become a sulphamidate, then another equivalent of neutral sulphate of potash, to transform itself into a metasulphamidate.

$$(2S^2O^2, AzO^3, H^3O^3 + 2KO):$$

after which, if the action of the water be continued, the metasulphamidate, by the reaction of these principles, will be itself transformed into 2 equivalents of neutral sulphate of potash, and 1 equivalent of bisulphite of ammonia.

If we now add to the sulphazotate, not only water, but also oxide of silver, or peroxide of lead, two new acids, and consequently two new salts will also be produced. Scarcely has the water, even when cold, come in contact with the salt and the oxide, before the action manifests itself. The liquid becomes of a violet color, and rapidly deposits a very large number of beautiful needles of a golden yellow, which constitute the new salt sulphazitate; and, in addition to this, it retains a new salt, metasulphazotate, crystallisable, by concentration, in very beautiful white rhombohedri.

The reaction takes place between 2 equivalents of sulphazotate and 2 equivalents of oxide of silver. The oxide of silver is reduced, and the two new salts are represented thus:—The sulphazotate by S^4O^5, AzO^3, $HO + 2KO$; and the metasulphazotate by S^2O^6, S^4O^5, AzO^3, $3HO + 3KO$. 1 equivalent of potash and two equivalents of water remain in the liquid.

Here, then, are nine new acids, all represented in their composition by a certain number of equivalents of sulphurous acid; and sometimes another acid of sulphur, by 1 equivalent of nitrous acid, and by 3 equivalents of water, without the acid.

Among all these acids, the sulphazidic acid alone can be easily obtained without undergoing a change; the others have no stability excepting in the presence of energetic bases, such as potash, ammonia, baryta, strontian, lime, and oxide of lead.

Subjected to the action of lead, all these sulphazotates are easily decomposed, all producing sulphate of potash and sulphite of ammonia, sometimes neutral, sometimes acid water, and, in addition to these, nitrous vapors, when sulphurous acid only enters into their composition, to the extent of 3 or 4 equivalents.

Warm, and even cold water, after a lapse of time, subject them to the modifications we have already described.

Boiling water produces a complete reaction among their principles, and produces sulphates of potash and ammonia; sometimes the salts are acid, sometimes also they give out oxygen, that is, when there is more than is necessary for the formation of sulphuric acid; finally, at other times, the water is decomposed—this occurs when there is not sufficient hydrogen to form the ammonia. All this variation occurs according to the composition of the salts, the metasulphamidate is the only exception; it resists the action of boiling water.

Several of the salts deserve a separate examination, above all, the sulphazilate and sulphazidate of potash.

The sulphazidate, which is produced by the cold process, by contact with sulphazotate of potash with water and oxide of silver, and which is precipitated in the form of beautiful yellow crystals, is one of the most stable of these acids.

Heat decomposes it, with a kind of explosion.

Its solution, which is of a beautiful violet color, becomes suddenly colorless, when heated to the boiling point, and strongly acid; it changes itself, with sulphate of potash and ammonia, and allows the oxygen to escape, a portion of which remains in the state of binoxide of hydrogen.

Exposed to the air, it becomes rapidly acid, and at the same time loses its beautiful yellow color, while binoxide of nitrogen is formed, which latter can be collected by placing salt in a close vessel.

Organic substances readily decompose it. Dissolved and poured on the skin, it immediately produces the disagreeable and characteristic odor produced by ferrate and manganate of potash under the same circumstances.

The sulphazidate of potash, the only one of the sulphonitrated salts, the acid of which can be isolated and preserved, is not less worthy of attention.

Sulphazadic acid, soluble in all proportions, is crystallisable and strongly acid, it is transformed at a boiling heat into bisulphate of ammonia, giving out oxygen, and producing binoxide of hydrogen, when the decomposition is slow.

Placed in contact with ground peroxide of manganese, it attacks it without the aid of heat, dissolves it, reduces it to the state of a protoxide, producing a brisk effervescence caused by the oxygen gas which is liberated.

But what is most remarkable is, that the sulphazidate of potash is decomposed in an instant by peroxide of manganese, which acts upon it in the same manner as upon oxygenated water; sulphazadic acid, by using 1 equivalent of oxygen, is transformed into 1 equivalent of ammonia and 2 equivalents of acid, which form, along with ammonia and potash, neutral sulphates of ammonia and potash; so also sulphazidate of potash, heated with an excess of potash, produces, at the same time, sulphate of potash and a disengagement of ammonia and oxygen.

Sulphazadic acid unites readily with baryta, lime, oxide of lead, and generally with all the bases, but, as the other acids are unstable, except in the presence of alkalis, it follows that to obtain sulphazotates of baryta, lime, or lead, we must have recourse to double decomposition; but in that case it forms double insoluble salts.

The sulphazotates produce no cloudiness with salts of strontian; in this we have a new and very delicate test to distinguish these from the salts of baryta.

These are the principal facts offered by M. Frémy's essay.

How, after these facts, are we to interpret the composition of the sulphazotate acids? Ought we to consider them as composed of sulphur, oxygen, hydrogen, and nitrogen, or as compounds of a certain number of equivalents of an acid, of sulphur, nitrous acid, and water.

For example, the three acids; sulphazous, sulphazic, and sulphazotic contain—

The first:

3 equivalents of sulphur
12 equivalents of oxygen
1 equivalent of nitrogen
3 equivalents of hydrogen
$= S^3AzO^{12}H^3$.

The second:

4 equivalents of sulphur
14 equivalents of oxygen
1 equivalent of nitrogen
3 equivalents of hydrogen
$= S^4AzO^{14}H^3$.

The third:

5 equivalents of sulphur
16 equivalents of oxygen
1 equivalent of nitrogen
3 equivalents of hydrogen
$= S^5AzO^{16}H^3$.

Hence we may suppose that the molecules of the acid are formed of elements grouped together in a quaternary form, as we may see by the preceding formulæ, or otherwise, that each equivalent of acid contains for 1 equivalent of nitrous acid, and for 3 equivalents of water—as follows:

Sulphazous acid, 3 eq. of sulphurous acid.
Sulphazic acid, 4 eq. of sulphurous acid.
Sulphazotic acid, 5 eq. of sulphurous acid.

In the first case, the formulæ are complicated; in the second, they are simple, and represent bodies already known; but when united they concur in producing new bodies.

In other respects, in both hypotheses, the phenomena are easily explained. The disengaging of oxygen, and the production of ammonia are easily conceived. It is true we know not how to produce the sulphazites, the sulphazates, and the sulphazotates, by pouring sulphite of potash upon strongly alkaline nitrite of potash; but the sulphammonate is easily prepared by this process, and besides, do we not know that sulphurous acid unites itself with nitrous acid and water, so as to form a peculiar acid, which we find in leaden vessels, and of which the nature is the same.

We are far from asserting that the elements are grouped in this manner; they may be, as we said in the first instance, and as the author is tempted to believe, observing that the acids would be then, to a certain extent, organic acids, in which the sulphur would take the place of the carbon. This question is the same as that whose object is to ascertain if a sulphate is formed of sulphur, oxygen, and metal, or of sulphuric acid and oxygen, &c.

This last supposition is more convenient for the explanation of the facts, and on this account it is preferred by chemists.

In any case, M. Frémy's essay is replete with new, numerous, and unexpected observations. It is a grand and beautiful work that required great ability and acumen, and if by his repeated and important experiments, M. Frémy had not already placed himself in an elevated position as a chemist, his new essay would undoubtedly assign it to him.

CHEMICAL EXAMINATION OF THE YOLK OF AN EGG.*

BY M. GOBLEY.

In a former essay I pointed out the presence of oleic, margaric, and phosphoglyceric acids,

* *Comptes Rendus.*

in the yolk of an egg. In the paper I present to-day, I think I can prove by my experiments that the yolk of an egg contains, in addition to water, an albuminous or vitelline substance, oleine, margarine, cholesterine, salts, two different coloring matters, fleshy extract, traces of lactic acid, and traces of iron.

The quantity of water has been determined by heating the yolk of an egg in a sand-bath, until it ceases to lose weight. Before you submit it to this operation, it must be entirely deprived of the albumen with which it is surrounded. The mode of proceeding is extremely simple—it consists in placing the yolk in a cloth, and rolling it about until it no longer moistens it.

The albuminous or vitelline matter has considerable analogy to albumen, from which it differs chiefly in its composition. It has been obtained perfectly free from fatty matter, by washing the yolk of an egg, deprived of its albumen, and drying it in the air on plates. The alcoholic treatment was continued until the vitelline was entirely deprived of color. The yolk of an egg yields, in this manner, 16·557 per cent. Submitted to analysis, the vitelline, prepared by the process just indicated, gave results that agreed with those of Messrs. Dumas and Cahours.

The yolk of an egg is not an ordinary emulsion, that is, a liquid in which a fixed fatty matter is found suspended in water solely by means of an albuminous substance, as is generally believed. The ordinary emulsion may be mixed with water without any separation of its elements; while there is a separation, when a great quantity of this liquid is added to the yolk of an egg. Among all the properties of the yolk of an egg, the most remarkable it possesses is that of dissolving in weak vegetable acids; the liquor retaining merely a little of opaline.

The oil of an egg consists chiefly of oleine and margarine; but it also contains cholesterine, and a coloring matter. It contains neither sulphur nor phosphorus, as is generally believed. A short time after its preparation, it deposits a solid matter, the quantity of which is greater in proportion to the coldness of the atmosphere. The deposit, which, up to the present time, has been supposed to consist of stearine, in union with a small quantity of oleine, is in reality composed of margarine, oleine, cholesterine, and a coloring matter. To separate the elements of which it is composed, it must be washed several times in boiling alcohol at 176°, which removes the cholesterine and the coloring matter, and also a small quantity of oleine and margarine. In fact, if it be saponified by means of potash, it furnishes glycerine, and oleic and margaric acids, which have to me always exhibited the same properties and composition as those attributed to them by M. Chevreul.

Cholesterine was discovered in the yolk of egg by M. Lecanu, and accurately described by that chemist. Perhaps there was a doubt as to the identity of this product with that which M. Chevreul obtained from biliary calculi; in fact, the cholesterine of M. Lecanu has its melting point at 290°, that of M. Chevreul being 278°. It was important, therefore, to prove that the cholesterine of the yolk of an egg was identical with that of the biliary calculi. When I submitted the cholesterine of the yolk of an egg to analysis, I obtained numbers that perfectly agreed with those of M. Chevreul. I then endeavored to account for the difference in the melting points; for that purpose I made a comparison in the same sand-bath between the two descriptions of cholesterine, and I found the two authors completely agreed; only M. Chevreul had observed, as he says in his "Treatise on Fatty Substances," the moment when the melted mass became solidified, and M. Lecanu, that when it first fused.

The cholesterine of the yolk of a egg is, therefore, identical with that of biliary calculi; there, consequently, exists only one kind of cholesterine, always exhibiting the same composition and the same point of fusion. 100 parts of the yolk of an egg contain about 0·438 of this substance.

The cholesterine is not kept in solution in the yolk of an egg solely by means of the oily substance; the soapy portion also must possess the same property, for the oil of the egg cannot keep the whole of it in solution at ordinary temperatures. Wagner observed that an aqueous solution of four parts of soap dissolved one part of cholesterine; therefore, as the proportion is rather higher in the yolk of an egg, we may be allowed to suppose that it is partly dissolved by its intervention. Is it the same in the case of the blood and the bile? Is it not because the quantity of soap is not sufficiently considerable in the bile that a part of the cholesterine is separated to form biliary calculi? According to this hypothesis, preparations of soap would be extremely beneficial to persons suffering under this disease.

Turmeric paper and the red paper of turnsole do not change color when in contact with the yolk of an egg; the blue paper of turnsole seems, on the contrary, to assume a slight red tinge. The yolk of an egg must, therefore, be neutral, or very slightly acid. Be it how it may, it is certain that by boiling it in

water we obtain an acid liquid, which becomes more acid when reduced to a small quantity, by the addition of pure alcohol. The precipitate produced by the latter consists of an earthy phosphate and an animal matter; this seems to prove to me that the acidity of the liquid is concealed by the phosphates. The filtered liquid contains a certain quantity of that indefinite substance to which M. Berzelius has given the name of fleshy extract (*extrait de viande*), and imparts to ether, after it has been evaporated, an acid which has presented me with all the properties of lactic acid.

The composition of the liquid obtained, by acting on yolk of egg by means of water, is very remarkable, for we discover in it all the principles chemists have met with in the gastric juice, chloride of sodium, chloride of potassium, hydrochlorate of ammonia, sulphate of potassium, phosphate of lime, phosphate of magnesia, and animal matter.

The presence of lactic acid in the yolk of an egg is of high importance in physiology; the property it possesses of being dissolved leads me to think that it is the principal digestive agent in the chick, and that by its intervention a part of the phosphates enter the body of the young animal.

To obtain the salts of the yolk of an egg, it must be first acted on by boiling water; by this means we remove the soluble salts and a portion of the earthy phosphates. The residue is submitted to the action of water, acidulated by acetic acid, which yields, by evaporation and calcination, phosphates of lime and magnesia.

100 parts of yolk of egg yield, on the average, of chloride of sodium and potassium, 0 gr. ·268; sulphate of potash, 0 gr. ·009; and phosphates of lime and magnesia, 0 gr. ·402. One of the elements of the yolk of an egg has not, as yet, been deprived of all the phosphates it contains—it is the vitelline, which gives it up neither to ether nor acetic acid. To estimate what it retains, the residuum of the two preceding operations has been exhausted by ether and boiling alcohol; 0 gr. ·984 of this substance yielded, by calcination, 0 gr. ·035 of phosphate, which shows that the yolk of egg contains more than 1 per cent. of earthy phosphate. In addition to this, the yolk of egg contains hydrochlorate of ammonia.

Prout imagined that eggs, at the close of incubation, contained more lime and magnesia than new laid eggs. According to his experiments, the first contained 0 gr. ·382 per cent., and the second only 0 gr. ·099. Not knowing to what to attribute this great difference, he supposed that the excess of lime and magnesia either came from the shell, or was produced from every part by the act of vivification, at the expense of other substances, hypotheses which he has himself acknowledged to be inadmissible. There is no doubt his mode of analysis was defective, for I have collected from the yolk of an egg alone, more lime and magnesia than he found in the whole egg after incubation. The proportion of saline matter that exists in new laid eggs must be the same as in eggs that have been sat on; the state of combination of the salts may have been altered by incubation, but I do not think the quantity could vary.

The yolk of an egg is, as we know, of an orange yellow color; M. Chevreul imagined that this arose from the union of two coloring principles, one yellow and the other red; that afterwards, by close connexion, one becomes like the yellow matter of bile, and the second like the red substance of the blood. In the different processes to which I have subjected the yolk of an egg, I have recognised the existence of these two principles; but I have never been able to separate them perfectly. The red coloring matter has appeared to me to be more soluble in alcohol than the yellow. I have found iron in the red coloring principle, and the yellow coloring principle has appeared to me to have an analogy with the yellow substance of bile. In this manner the ideas of M. Chevreul are, to some extent, confirmed.

ON THE ORES OF PLATINUM, OSMIUM AND RUTHENIUM.*

BY M. CLAUS.

M. CLAUS, Professor of Chemistry at Casan, has been for some time engaged in the examination of the metals that are found in the residum of palatinum ore; he has arrived at the same results as those of M. Frémy, during his last experiment on osmium; but having followed a different plan, he was led to the discovery of a new metal to which he gives the name of ruthenium.

M. Claus operated on fifteen pounds of the residuum in the following manner, he kept it in a state of fusion along with double its weight of nitre in a Hessian crucible, the melted mass was then thrown into an iron vessel, and steeped in water, there was a soluble portion A, and an insoluble portion B.

The soluble portion A, was of a red brown color, had a slight smell of osmic acid, and

* *Bull. Phys.. of the Academy of St. Petersburg.*

contained chromate, osmiate, silicate, iridiate, rutherate, and titanate of potassium, as well as nitrite and free potassium. It was concentrated by evaporation, and deposited a blackish-green precipitate. This precipitate consisted of a powder of the same color, and little red octohedrons: the latter could be evaporated by means of boiling water, and crystallised when the solution became cold. This salt was no other than osmite of potassium ($OsO^3,K^2O,+2Ag.$) already described by M. Frémy: the powder contained a considerable quantity of chrome and ruthenium, which M. Claus, in the first instance, mistook for iridium.

As to the liquid, in which the precipitate was formed, it contained a considerable quantity of osmium: he added a sufficient quantity of weak sulphuric acid to make it slightly sour, it was then distilled, and he collected osmic acid, which was deposited in a very beautiful white crystals. This acid, converted into a sulphuret, by the addition of H^2S, will answer for all the preparations of osmium; the sulphuret, being mixed with chloride of potassium, and submitted to the action of moist chlorine, in a long porcelain tube, leaves a residuum of chloro-osmiate of potassium, mixed with metallic osmium; while chloride of sulphur and a small quantity of osmic acid pass over; the water of the receiver, becomes, at the end of a short time, of a dark color, and then contains the blue combination of osmic and sulphurous acid. If the residuum be washed in boiling water, a large quantity of metallic osmium remains, and the solution, as it cools, deposits octohedrons of the salt of osmium, of a red brown color, while the mother water furnishes a black oxide, if it be precipitated, while warm, by carbonate of soda.

I now come to the insoluble part; this M. Claus submits to the process of distillation with half its weight of aqua-regia, diluted with distilled water; in which case a considerable quantity of osmic acid passes over. The residue was mixed with water and the solution, decanted off. A deposition, C, remained behind, to which we shall return. The solution contained iron and the new metal; it was precipitated by potash, and the precipitate dissolved in hydrochloric acid.

This solution contained the new metal; it gave a black precipitate by the addition of metallic zinc. Mixed with common salt, and acted upon by chlorine, at a red heat, the ruthenium thus precipitated yielded a black mass which, dissolved in water, becomes of an orange color; this solution is easily distinguishable from that of iridium or rhodium, it yielded, with ammonia, a velvety black precipitate, and became, by the addition of sulphuretted hydrogen, of a dark azure blue, and at the same time a black sulphuret was precipitated. Neither rhodium nor iridium has a similar reaction.

The chlorides of potassium and ammonium produce, with the solution of ruthenium, double crystalline salts of little solubility, which are with difficulty distinguishable from the corresponding double chlorides of iridium, when they are not examined with a good microscope.

The deposit, C, yielded M. Claus fresh quantities of this new metal, by fusion with nitre. The nitre, in a state of fusion, converts the metal into ruthenate of potassium, perfectly soluble in water; in the crude product this salt is accompanied by a chromate and a silicate. The solution is of a beautiful orange tinge, and if we add a small quantity of nitric acid, a black and plentiful precipitate is formed, consisting of a combination of oxide of ruthenium, and potash still containing silcia. This precipitate is to be dissolved in hydrochloric acid and the solution evaporated, taking care to supply the place of the acid by degrees; the substance being then diluted with water, allows the silica to be deposited. In this manner we obtain a solution of chloride of ruthenium, which you may mix with a saturated solution of chloride of potassium so as to precipitate the double salt, which is afterwards purified by repeated crystallisation.

M. Claus made several experiments on this metal, the first portion of which he has published.

Ruthenium is of a blackish-gray color, shines but little if it has been obtained by the reduction of the double chloride, but possesses a metallic lustre if it has been obtained by the reduction of the oxide, Ru^2O^3, it is much lighter than iridium.

9·831 grains of this metal calcined for the space of three hours, absorbed 0·155 grains of oxygen, being converted into a bluish black oxide which is not reduced by a red heat; but hydrogen gas reduces it.

When it is melted with nitre, it is converted into a blackish-green mass, which dissolves in water and tinges it of an orange color, yielding rutheniate of potassium, which possesses a very weak but peculiar smell. Acids throw down a black oxide. Caustic potash also readily dissolves the metal produced by calcination with nitre.

These tests are already sufficient to distinguish iridium and ruthenium, but there are still many others sufficiently characteristic. Perchloride of ruthenium has a very remarkable action on many bodies, thus, for example, sulphuretted hydrogen only partly

precipitates the metal in the state of a black sulphuret, while it converts the bichloride into a protochloride of an azure blue color, which is with difficulty decomposed by sulphuretted hydrogen.

If we place a piece of zinc foil in the orange-colored solution of the perchloride, the liquid also, at the end of a short time, becomes blue, but it afterwards loses its color, and precipitates metallic ruthenium, the reduction, however, is never complete.

Alkalies and borax precipitates the perchloride, of a black color.

The ferro-cyanuret of potassium does not, in the first instance, suffer a change of color, but it becomes discolored by degrees, and finally the liquid assumes a green hue like that of a solution of chrome.

The cyanuret of mercury produces a blackish-blue precipitate, the solution assuming a blue color.

One of the best tests for this metal as well as for iridium is nitrate of silver. This salt produces a black precipitate of perchloride of ruthenium, the precipitate consists of a mixture of chloride of silver, and oxide of ruthenium; at the expiration of about twenty-four hours it is partially dissolved, for the oxide of ruthenium (losing, probably, its oxygen,) dissolves in free nitric acid, assuming a cherry color, and leaving behind, the chloride of silver. If we add ammonia in excess to this liquid, the chloride of silver is dissolved at the same time as the black oxide of ruthenium is precipitated.

Chloride of iridium acts in the same manner, presenting also other phenomena. It yields with nitrate of silver, an indigo-colored precipitate, but by degrees it loses its color, and at the end of two hours the loss of color is complete, so that the chloride of silver is found deposited in a colorless liquid. If we afterwards add ammonia, the chloride of silver is dissolved, and the iridium remains in an insoluble state, under the form of a yellowish-white compound. This reaction is extremely striking, and enables one to discover the smallest traces of iridium in other metals.

Under certain circumstance ruthenium forms chlorides which are marked with all the colors of the rainbow—green, violet, purple, red, and orange. The orange-colored chloride is composed of $RuCl^3$ (Ru^2Cl^6, Claus); it is the most prominent of all, and is easily obtained in combination with chloride of potassium or ammonia:

$$2KCl + RuCl^3$$

It consists of orange-colored cubes, which, to the naked eye, appear as a crystalline powder, of a brown color, having a tinge of violet. The neutral salt is easily decomposed in an aqueous solution, depositing a black precipitate; but this decomposition does not take place if a free acid is present.

When dry chlorine is made to pass over ruthenium heated to a red heat, it produces a volatile chloride, which is given off as a yellow smoke, but the greater part of the metal is not attacked.

To the foregoing particulars M. Claus has added several analytical facts. The result is that ruthenium must possess the same atomic weight as rhodium, while it differs materially in the arrangement of its atoms.

The best means of ascertaining the presence of ruthenium in the ore of platinum is the following:—Melt it with an excess of nitre in a small platinum spoon, exposing it to a strong heat until the mass no longer swells, but becomes perfectly liquid, then allow it to cool, and dissolve it in a small quantity of distilled water. A few drops of nitric acid produce in the orange-colored solution, a black precipitate, consisting of ruthenium and potash. If we add hydrochloric acid to the liquid in which the precipitate is found, and heat it in a porcelain capsule, the oxide is dissolved, and by concentration assumes a beautiful orange color. Finally, if we cause sulphuretted hydrogen to pass through the solution until it has become almost black, and then filter it, a liquid of a beautiful sky-blue color will pass.

EXPERIMENTS ON SEVERAL NEW SERIES OF DOUBLE OXALATES.*

BY M. REES REECE.

The memoir I have the honor of presenting to the Academy gives an account of several series of double salts, which I have discovered by studying the action of alkaline or earthy bases on the oxalates and sesquioxides.

We know that the salts of lime only produce a slight precipitation of oxalate of lime, in a moderately concentrated solution of oxalate of iron, chrome, &c., forming none in a weak solution of oxalate of chrome and potash—a salt discovered by Gregory, and in which there are 3 equivalents of oxalic acid, combined with an alkaline base. The same salts, in a concentrated solution, produce an abundant precipitate, which is considered to be oxalate of lime, and in which I have found a notable proportion of chrome.

These are the facts which served me as a starting point.

The combination, by means of which I

* *Comptes Rendus.*

have prepared the double salts, which are are the objects of this essay, is an oxalate of chrome and ammonia, having the same formula as the salt of Gregory, but to which it is preferable on account of its great solubility.

A concentrated solution of this salt, mixed with its own volume of chlorides of strontium, barium and calcium, produces voluminous precipitates, which, separated from their mother-water, and crystallised, have the following composition :—

Oxalate of chrome and baryta (A.) ..... $3C^2O^3 + Cr^3O^3 + 3(2O^3BaO) + 12HO$.
Oxalate of iron and baryta (B.) ..... $3\overline{O} + Cr^2O^3 + 2(\overline{O}BaO) + 18HO$.
Oxalate of chrome and strontian ..... $3\overline{O} + Cr^2O^3 + 3(\overline{O}StO) + 18HO$.
Oxalate of chrome and lime ..... $2(3\overline{O} + Cr^2O^3) + 3(\overline{O}CaO) + 36HO$.

If we substitute oxide of iron for oxide of chrome, we have salts corresponding with the base of iron, and which are represented by the following formulæ :—

Oxide of iron and baryta ..... $3O + Fe^2O^3 + 3(OBaO) + 7HO$.
Oxalate of iron and baryta ..... $3\overline{O} + Fe^2O^3 + 3(\overline{O}BaO) + 12HO$.
Oxalate of iron and strontian ..... $3\overline{O} + Fe^2O^3 + 3(\overline{O}StO) + 18HO$.
Oxalate of iron and lime do not crystallise.

If the oxalate of chrome is replaced by alumine, we have salts resembling those that are represented by

Oxalate of alumine and baryta ..... $3O + Al^2O^3 + 3(OBaO) + 10HO$.
Oxalate of alumine and baryta ..... $3\overline{O} + Al^2O^3 + 3(\overline{O}BaO) + 30HO$.
Oxalate of alumine and strontian ..... $3\overline{O} + Al^2O^3 + 2(\overline{O}StO) + 18HO$.

The oxalate of alumine and lime cannot be separated in a state of purity, on account of its insolubility.

These salts crystallise in small silky needles, those of chrome are of a dark violet color, those of iron of a greenish yellow, and those of alumine of a dazzling white.

They are soluble in about thirty times their weight of boiling water (excepting the salts of chrome and lime, alumine and strontian, which are decomposed by water), they are scarcely soluble when cold.

All the alkalies decompose them, by precipitating their sesquioxide and earthy oxalate. The salts of chrome, however, act differently with ammonia, which does not produce the least precipitate with oxide of chrome, even when the baryta has been separated by means of sulphuric acid.

The ferruginous salts are decomposed by the sun's rays, producing an abundant disengagement of carbonic acid, even when the crystals are dry.

I shall conclude this summary of my work, by making a few remarks on the important post these salts hold with a view to analysis, and the more so because it was with this object in view that I undertook the experiments which are the subject of my memoir.

I think I have succeeded in explaining the fact, which has been so long known, of the solubility of oxalate of lime in solutions of the sesquioxides.

Iron, aluminum, and chrome are always separated from their minerals as peroxides; lime and strontia as oxalates; but we know that lime cannot be separated from the solution of the sesquioxide; this circumstance is owing to the formation of a double salt of which oxalate of lime forms a part.

In this case we are obliged to precipitate the sesquioxide by means of ammonia, which leaves the oxide of lime free in the solution; there is the danger that the carbonic acid of the air may affect the lime, and thus produce an excess in the weight of the sesquioxide.

It is particularly in the case of alumine and chromic acid that the error may be the greatest; it would be very easy to avoid this difficulty, and the study of these salts has suggested the following process to me: to be more intelligible, I shall, as an example, select a mineral containing iron and lime. I dissolve it in hydrochloric acid, then I add such a quantity of oxalic acid, as shall, if the liquid be diluted, produce no precipitate; I now add oxalate of ammonia in excess, which will precipitate the whole of the oxide of lime; I separate them by filtration, and the ferruginous oxide remains in the solution, entirely free from lime; it is then itself precipitated in the usual manner by means of ammonia.

This work was executed under the directions of M. Pelouze, in his own laboratory, and I beg of him to accept my most sincere thanks.

ATOMIC WEIGHT OF SULPHUR AND GOLD.*

BY BERZELIUS.

The *Recueil des Memoires de l'Academie des Sciences*, of Stockholm, No. 4, 1845, contains a note of Berzelius, in which that illustrious chemist attacks Messrs. Erdmann and Marchand on account of their inclination to amplify atomic weights. We know that these skilful chemists, at the conclusion of a series of recent experiments, very carefully performed, proposed, in round numbers, 200 as the atomic weight of sulphur, that is to say, exactly double that of oxygen! The number they adopted after M. Berzelius was 201·16.

But now, M. Berzelius having revised this last number, reduces it to 200·8, having made a slight correction in the atomic weight of lead. The animadversions of M. Berzelius have, therefore, little foundation, for how can he account for his decimal, when the number he adopts, is not, itself, a direct result, but calculated by the assistance of three or four other atomic weights.

The atomic weight of gold, 2486·0 was calculated by means of the weight of gold precipitated from the chloride of that metal by means of a known weight of mercury. M. Berzelius has come to another conclusion by following a different process: he reduced, by means of hydrogen gas, the auro-chloride of potassium, several times crystallised; this salt then yields a residuum of gold and potassium, which are easily separated. The average of several trials pointed out the number 2458·33.

AN ANALYSIS OF VARIOUS ANCIENT BRONZE COINS DISCOVERED IN THE DEPARTMENT OF THE OISE.

BY M. AMÉDÉE MOISSARD.

A FEW months since M. A. G. Houbigault, member of the Society of Antiquaries of Picardy, and of the Council General of the Department of the Oise, forwarded to M. Baudrimont seven coins of ancient bronzes found in various localities, expressing a desire that they might be subjected to chemical analysis. M. Baudrimont requested me to undertake the task, which has been performed in his laboratories, and under his direction. I have communicated the result to the Academy, believing it might be of some interest to the learned persons who are engaged on the subject of Antiquities.

The coins examined are composed of an alloy of copper and tin, in various proportions, with traces of arsenic, sometimes of silver, but never of zinc, iron, or lead.

The process adopted was extremely simple; the alloy was subjected to the action of hydronitric acid, and the product evaporated to the consistence of syrup. The residuum dissolved in water, left insoluble stannic acid, which was separated by decantation, washing, and filtration, and afterwards placed in the same capsule in which the operation had been performed. The liquid when tested by sulphate of potash, gave no indication of lead. By chloride of soda, it sometimes exhibited traces of silver. The liquid acidulated and subjected to the action of a hydro-sulphuret, precipitated all the copper contained in the limpid portion, that rested above the precipitate, I never met with iron or zinc, nor any other metal that could leave a precipitate by evaporation.

No. 1 was found, in Dec. 1838, in the forest of Ageux, by Theodore le Roi, this alloy was white and extremely hard,

Copper	0·8124
Zinc	0·1876
Arsenic	traces of
	1·0000

No. 2 was found in the environs of Cherbourg,

Copper	0·8929
Zinc	0·1071
	1·0000

No. 3, presented by M. Wattlebled of Nogeul. A beautiful yellow alloy, difficult to cut with a graver, the chips brittle as if cast. (This instrument was found in a quarry of limestone, which had been abandoned for ages.)

Copper	0·9052
Zinc	0·0948
	1·0000

No. 4, found in the Roman camp of Bailleul-sur-Therrain, near Bresle.

Copper	0·8280
Zinc	0·1720
Arsenic	traces of
	1·0000

No. 5, found at the Roman camp at Bresle, rather yellower than the preceding.

Copper	0·8029
Zinc	0·1971
	1·0000

No. 6, found in the environs of Porte-Sainte-Maxence, in 1841, this alloy was soft.

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Copper, and traces of silver....	0·9044
Tin, and traces of antimony ..	0·0956
Arsenic	traces of
	1·0000

No. 7, found in the environs of Pont-Sainte-Maxence, in 1841, this alloy is rather whitish and hard.

Copper and traces of silver..	0·8802
Tin	0·1198
Arsenic	traces of
	1·0000

The alloys 1 and 7 differ from all the others by their color and hardness, but their composition does not account for this fact.

A NEW SUBSTANCE DERIVED FROM UREA.*

BY WÖHLER AND LIEBIG.

When we submit urea to a careful distillation, it is converted, to a great extent, not into cyanuric acid, but into a white substance, $C^3 H^4 N^4 O^2$, which we obtain in a state of purity by washing the residuum in boiling water. It is a white powder, resembling chalk, perfectly insoluble in water, but extremely soluble in alkalis and acids, from which it is again precipitated when they are neutralised. Heated in a dry state, it is converted into *mellon* (nitrogen and carbon).

Messrs. Liebig and Wöhler consider this a new substance, but it is nothing else than ammelid, the same compound which is also obtained by the action of acids on melam and melamin. I have made several experiments on this pretended new substance, and have prepared and analysed, among others, the argentic combination discovered by M. Knopp, which contains—

$$C^3 (H^3 Ag) N^4 O^3.$$

If Messrs. Liebig and Wöhler had taken into account the formula I attributed to ammelid in my work, and which is precisely the same as that by which they represent their new substance, they would not have been long in perceiving that its composition and all its properties are the same as those of ammelid.

I shall very soon have an opportunity of proving their identity, in a work on the mellonides.

When urea is gently heated, it only gives out carbonate of ammonia and free ammonia; the residue is pure ammelid.

$$4CH^4N^2O = CO^2 + 4NH^3 + C^3H^4N^4O^2.$$

* *Journal de Pharmacie.*

ON THE COLORING PRINCIPLE OF LICHENS.*

BY M. SCHUNCK.

M. Schunck, some years back, discovered, during the manufacture of argol, a crystallisable principle, to which he gave the name of *lecanorine*, and which is remarkable for the property it possesses, of being changed into orcine during certain reactions. M. Schunck's new work gives the analysis of this lecanorine, as well as a description of several of its derivatives; unfortunately the author has not well calculated the relations between these different bodies, and he admits into his essay formulæ that have no appearance of correctness, and for which we shall be obliged to substitute others more precise.

But first let us pass to the extraction of the lecanorine. M. Schunck employed lichens a large proportion of which were in a state of decay, and consisted, principally, of lecanora parella, mixed with a certain quantity of sphærularia scrupea. He steeped them in warm ether, which dissolved the lecanorine, and deposited it in crystals when cold: boiling alcohol extracted still more from the residue. The product is usually mixed with another principle, *parelline*, as well as a substance already known as *pseuderythrine*, which is a peculiar kind of ether. We shall return presently to these two substances. M. Schunck describes very minutely the processes he employs to effect their separation.

Lecanorine or lecanoric acid.—This substance offers the following properties: it is soluble in water to a very small extent; it part requires 2500 parts of boiling water, and it is deposited by cooling in the state of small crystals. 1 part is dissolved in 15 parts of alcohol at 0·80, and in 80 parts of ether, at the common temperature. These solutions have a very distinct acid action. The lecanorine is also dissolved in carbonates, accompanied by effervescence, and the term lecanoric acid is very well adapted to it. The solutions in lime or baryta water are coagulated by alcohol.

M. Schunck represents crystallised lecanorine by $C^{18} H^{16} O^8 + Ag$, but this formula is not exact, and does not correspond with the reactions of these substances. According to my idea crystallised lecanorine contains—†

$$C^{16} H^{14} O^7 + Ag.$$

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† I have, in my book (ii., 170) adopted the formula of M. Schunck, already proposed by M. Liebig, observing that it ap-

We shall see, presently, that this formula completely explains the transformations of lecanorine.

The following are the principal reactions of this substance:—

It is easily dissolved in cold lime or baryta-water, and is precipitated from these solutions by acids in a gelatinous state; but by boiling it produces a carbonate, and is then converted into orcine. This metamorphosis is expressed according to my formula in the following manner:—

$$C^{16}H^{14}O^7 + H^2O = 2(CO^2 + C^7H^8O^2).$$

Acted on by heat, in the presence of concentrated sulphuric acid, it also yields orcine.

Nitric acid converts it by boiling into oxalic acid. Boiling acetic acid easily dissolves it, and when cold, deposits it in the form of needles.

A few drops of a solution of bichloride of iron produces a deep purple color in a alcoholic solution of lecanorine.

An alcoholic solution of lecanorine is not immediately precipitated by acetate of copper, but after a time it produces a clear apple-green deposit. It is not precipitated by an alcoholic solution of acetate of lead, corrosive sublimate, chloride of gold, or nitrate of silver.

An ammoniacal solution of lecanorine produces a white precipitate of nitrate of silver; but the precipitate is reduced by boiling, and it covers the sides of the glass with a shining layer of metal. Chlorides of gold is also reduced.

Boiled with alcohol lecanorine is converted into pseuderythrine or lecanoric ether: the presence of an acid does not appear to assist this metamorphosis. With spirit of wood an analogous compound is obtained.

Pseuderythrine or lecanoric ether.—This substance has been obtained by Hearen by boiling erythrine in alcohol; it is easily produced by boiling an alcoholic solution of lecanorine for several hours. When cold it separates in small crystalline tablets or needles; the mother-liquor also contains a large quantity of orcine. The product is easily purified by crystallisation in boiling water.

It is much more soluble in ether than in alcohol, and the solution appears neutral when test papers are applied. It is fusible, and it can be sublimed without decomposition.

Concentrated sulphuric acid readily dissolves it, and water precipitates it from the solution, without alteration. The compound becomes brown by boiling.

It dissolves in caustic alkalis, and acids precipitate it from them in a crystalline form. Boiled with the alkalis it separates from the alcohol, and produces orcine. If acted upon by caustic baryta, we perceive a carbonate deposited.

M. Schunck represents this lecanoric ether by $C^{22}H^{26}O^9$, but this formula does not agree with the reactions, and in addition to this, I know of no volatile substance that contains O^9 in its equivalent, without decomposition.*

$$C^{10}H^8O^4.$$

The following, according to this formula, is the mode of formation of pseuderythrine by means of alcohol and lecanorine.

Lecanorine.		Alcohol.		Pseuderythrine.	
$C^{16}H^{14}O^7$	+	C^2H^6O	=	$C^{10}H^{12}O^4$	+
		Orcine.			
		$C^7H^8O^2$	+	CO^2.	

Observe, I take into account the simultaneous formation of orcine, which M. Schunck obtained in great quantity, while this chemist looked upon pseuderythrine as simply a lecanoric ether, which is manifestly wrong.

My formula also agrees with the transformation of pseuderythrine into orcine by means of boiling alkalis, for

$$C^{10}H^{12}O^4 + H^2O = CO^2 + C^3H^6O + C^7H^8O^2.$$

Pseuderythrine produces no precipitate in aqueous solution of acetate of lead, sublimate of mercury, or sulphate of copper, but

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My new formula agrees with M. Schunck's analysis, and with those of Messrs Rochleder and Heldt. At the atomic weight 75, it requires—

Dry lecanorine.	Calculation.	Schunck.	Rochleder and Heldt.	
Carbon	60·4	60·1	60·2	
Hydrogen	4·4	4·7	4·8	
Crystallised lecanorine.				
	Calculation.	Schunck.		
Carbon	57·1	57·2		
Hydrogen	4·7	4·8		

C. G.

* This formula perfectly agrees with every analysis.

	Calculation.	Liebig.	Kane.	
Carbon	61·2	60·8	61·2	61·9
Hydrogen	6·1	6·3	6·2	6·3
	Schunck.	Rochl. and Heldt.		
Carbon	60·7	61·6	61·4	
Hydrogen	6·1	6·4	6·4	

it precipitates subacetate of lead in abundance. Bichloride of iron is thrown down, of a dirty red color, it reduces with the assistance of heat, ammoniacal nitrate of silver, as well as chloride of gold.

M. Schunck, obtained by means of spirit of wood, a similar combination; it is not, however, as he affirms, $C^{20} H^{22} O^9$, but $C^9 H^{10} O^4$. It is obtained by boiling the lecanorine, for several hours, in spirit of wood.

The liquid is evaporated to dryness, and it is again dissolved in boiling water, which deposits the compound substance in silky needles. It is volatile without decomposition; more soluble in water than pseudo-erythrine, and in other respects exhibits the same reactions.

Orcine.—Is obtained in a state of perfect purity by boiling a solution of lecanorine in caustic baryta, the carbonate is separated by means of a filter, and it is evaporated until crystallisation takes place. The crystals are generally colored, but they can be purified by boiling them with alumine or oxide of iron, which removes the coloring matter. Orcine may also be distilled; but the crystals, nevertheless, always have a yellow or reddish tinge.

M. Schunck proposes two formulæ for orcine; $C^{18} H^{24} O^8$, and $C^{16} H^{20} O_8$, but they are both incorrect; analysis and various tests manifestly point out the formula $C^7 H^8 O^2 + Ag$, which makes dry orcine isomerical with saligenine.*

The following are some of the reactions of orcine. Nitric acid dissolves it with heat, it produces a yellow substance, and finally oxalic acid. Its aqueous solution produces no precipitation in solutions, sublimate of mercury, acetate of lead, sulphate of copper, or gelatine; but it yields with bichlorate of iron, a deep red colored precipitate, approaching a black; ammonia destroys this color; nitrate of silver is not changed by boiling, but if ammonia be added, it is reduced.

The action of chlorine upon orcine deserves examination. It produces, according to M. Schunck, a crystallisable compound, fusible, and partially volatile, reddening turmeric paper, and dissolving in the alkalis. M. Schunck did not analyse it; if, however, my ideas are correct, this substance is no other than chloride of salicyle. The formula I assign to orcine will completely account for the formation of this body, but experiment must decide.

Parellin or parellic acid.—In addition to the substances of which we have spoken, M. Schunck's essay contains the description of a new crystallisable body, which accompanies lecanorine in the lichens. The author has not studied its metamorphoses, so that the formula he proposes ($C^{14} H^{14} O^6$) gives no guarantee for its truth. The subject must be resumed.

* Dry orcine.

	My formula.	Dumas.
Carbon	67·7	67·7
Hydrogen	6·4	6·5

	Hydrated orcine.			
	My formula.	Schunck.	Dumas.	
Carbon	59·1	58·8	59·4	58·4
Hydrogen	7·0	7·0	7·6	7·0

My formulæ are calculated with the atomic weight 75, the analysis with the old weight.

ON THE VALERIANIC AND BUTYRIC ACIDS.*

AN EXTRACT FROM A LETTER FROM FRENCH CHEMISTS, TO M. DUMAS.

ALLOW me to describe to you several experiments which I have made on wheat damaged in the holds of vessels. As I was passing through the docks at Lorient, I was struck with the infectious and butyric odour arising from a great quantity of wheat then unlading. I endeavoured to extract the butyric acid from it, and the result of my experiments, undertaken along with Dr. Dovert and M. Garenel, was that a larger or smaller quantity of valerianic acid is formed in the damaged wheat, which is easily separated by the usual method. Butyric acid is produced at the same time, and it can be extracted from the liquid on which the oily valerianic acid floats. While decomposing the salt of soda formed by the saturation of the liquid, distilled over the wheat, by means of nitric acid, we obtain an oily stratum of valerianic acid, if we saturate the acid liquor, which is composed of nitrate of soda, free nitric acid, valerianic and butyric acid with soda, and we treat the whole with alcohol, we obtain a solution which, so to speak, is only composed of butyrate of soda, and a very little valerianate of the same base. By evaporating this salt to dryness, with a gentle heat, and decomposing it with the smallest possible quantity of nitric acid, very pure and sufficiently diluted, we obtain another oily stratum, which dissolves in water in all proportions (butyric acid), while the stratum obtained in the first instance (valerianic acid) is much less soluble. In an economical point of view, I can say nothing that is well established,

* *Comptes Rendus.*

sometimes the quantity of valerianic acid is very small, at other times on the contrary; it is sufficient (although much less in quantity than that produced by valerian) to promise a satisfactory result. It appears, then, that during part of the time fermentation is going on, valerianic acid is sufficiently abundant to make it worth while to extract it from the damaged wheat, which is of much less value than valerian. My two fellow laborers are about to continue their experiments, particularly in an economical point of view.

At present we have to discover what are the conditions of the valerianic fermentation, and the maximum of acid produced.

I imagine that the sea-water may play a very important part in the process; may not sea-salt, which, when alone, and in a strongly concentrated solution, arrests all fermentation, may it not, as met with in sea-water, retard it, by modifying it? The manner in which wheat is piled up in the hold of a vessel, ought also to be taken into consideration, for the moisture only enters a little at a time, and on that account, the wheat finds itself in a very peculiar state of fermentation.

As to the butyric fermentation, it may be explained by the presence of gluten, which, being only fibrin, would possess the property we have since established, of furnishing butyric acid by fermentation.

In the last hypothesis sea salt has no effect; it is the same as if we admitted that the mode of packing the wheat was the sole cause that the gluten is modified, and contains butyric (analogous or identical with casein) and also valerianic acids, which afterwards acts on the fecula.

Admitting, on the other hand, that the sea salt produces all these effects, we should say that the gluten, under its influence is converted into these two species of ferments.

These are the hypotheses that present themselves, and we will endeavour to resolve them in the best manner we can. I am about to commence by making comparative experiments on the principal varieties of fermentation, using both fresh and salt water, or water containing principles capable of modifying the different products of these fermentations. I mean also to endeavour to extract valerianic or butyric acid from bran that has been in contact with skins.

The valerianic odour is very decided in this substance. In case these acids exist in it, I shall be induced to believe that tannic acid acts in the same way as sea salt, by retarding, modifying, and even entirely changing the products of the putrid fermentation of the skins of animals.

THE ELECTRO-CHEMICAL THEORY APPLIED TO THE THEORY OF SUBSTITUTIONS OF M. DUMAS.

BY MR. REUBEN PHILLIPS.

The first position to be proved is this, that an element may exist in one compound as the electro-negative ingredient, and in another compound as the electro-positive body. This position, as far as I am aware, has often been surmised, but never proved, although its proof is most easy. For let us take any binary compound—for instance, chloride of potassium—the chlorine is here electro-negative, and the potassium positive. Now resolve the salt into its elements, and separately combine them with oxygen, generating the KO and ClO. Now (+K)+(—Cl) becomes, by being resolved into oxide of potassium and oxide of chlorine, (+K)+(—O), and (+Cl)+(—O); or if any suppose that hypochlorous acid is (+O)+(Cl), we have oxygen — in one combination, and + in the other; or, according to the former use, we have chlorine — in one compound, and + in another, so that either way the position is true, and, moreover, the method of proof is very general.

Let us now consider the above as applied to the theory of substitutions, taking for example the chlorocetice acid discovered by Dumas. This compound is produced by exposing acetic acid to the joint action of chlorine and the solar rays, by which the whole of the hydrogen becomes removed, and its place supplied by chlorine; thus making its formula $C^4\,Cl^3\,O^4+H$. We will now assume that the hydrogen in the radical of the acetates is in the electro-positive condition (but it will be seen that the proof holds good whether the hydrogen be considered as plus or minus, or partly plus and partly minus); when this radical is exposed to the action of chlorine, rendered active by the sun's rays, the hydrogen is removed, and hydrochloric acid is produced: by this action three equivalents of hydrogen are rendered as fully electro-positive as they can possibly be by the action of an equivalent of chlorine, and the whole of this electricity they obtain by virtue of their union with chlorine, hence the quantity of electricity which they previously possessed must have been transferred to other atoms; and since chlorine can take the electro-positive state, the electro-positive hydrogen, at the moment of its combination with chlorine, finds a ready recipient of its previous electricity in the chlorine, which thus becomes introduced into the radical, and possesses the same state as the hydrogen which it has supplanted, and

therefore the constitution of the radical $C^4 H^3 O^4$ is identical with $C^4 Cl^3 O^4$.

The foregoing, I think, clearly shows what may be expected to take place, when hydrogen is removed and its place supplied with chlorine; but this method of substitution is not peculiar to chlorine. The reason why chlorine stands pre-eminent as a substitute for hydrogen is, I think, this—that at common temperatures, and aided by the solar light, it is the body at our disposal which possesses the greatest aptitude for combining with hydrogen.

After this I cannot agree with Professor Draper that the electro-chemical theory fails to account for the displacement of such a body as hydrogen by chlorine, bromine, oxygen, &c.

A SIMPLE METHOD FOR PREPARING THE PURE SULPHATE OF MANGANIUM FROM THE NATIVE PEROXIDE.

BY MR. REUBEN PHILLIPS.

The native peroxide of manganium is to be pulverised and suspended in water, through which a stream of sulphurous acid gas is to be passed. The same arrangement of apparatus may be used, as would be employed were it designed to generate the hyposulphate of manganium; with this exception, that, there is no occasion for keeping the water containing the peroxide of manganium cool. The sulphurous acid, generated from sulphuric acid, should be made to traverse some vessel containing water, to condense any sulphuric acid which may be suspended in the gas, and also to remove from the gas any hydrochloric acid gas, which may be simultaneously liberated with the sulphurous acid, when the commercial sulphuric acid is used. I send the sulphurous acid through a U tube containing fragments of pummice-stone, which are saturated with water; and I also put some water in the tube, so that the gas may bubble through a vertical inch or two of water. The sulphurous acid is then conveyed into a two-necked bottle, containing the oxide of manganium suspended in water; and through the other neck of the bottle, a stirrer is inserted to prevent the oxide from subsiding.

The sulphurous acid becomes rapidly absorbed in the two-necked bottle, producing the sulphate and hyposulphate of manganium; to transform which latter salt into the sulphate of manganium, the contents of the two-necked bottle is to be transferred to a porcelain vessel, in which it can be boiled for about half an hour; at the end of which time, the hyposulphate will be very nearly decomposed; an excess of the peroxide of manganium should be used, which entirely prevents the evolution of sulphurous acid during the ebullition. The solution is now to be filtered, and evaporated to dryness; after which it may be gently heated until no more sulphurous acid is disengaged.

The salt thus obtained is very nearly white, possessing a scarcely perceptible rose tint. As I have obtained it, it has a slightly acid reaction; this, if required, can be rectified by a second solution, and the addition of a small quantity of carbonate of baryta. The salt contains no metal but manganium. I find the best test for a persalt of iron in a manganium salt to be the sulphocyanide of potassium.

AN ESSAY ON A NEW METHOD OF RECOGNISING SPOTS OF BLOOD.*

BY M. ORFILA.

About six years since, M. Persoz, professor of natural philosophy at the Faculty of Sciences of Strasbourg, informed me that since the year 1836 he had had recourse to hypochlorous acid for recognising spots of blood on a blouse on which there were also spots of wine.

"This acid," he says, "immediately destroys spots of every description, with the exception of those caused by rust or blood; these last become of a blackish brown color by contact with the acid; it is the more important to employ hypochlorous acid, because it often happens that spots of blood found on woven fabrics lose their property of dissolving in water, and consequently cannot be discovered by that means."

Some time after receiving this communication I applied, in conjunction with M. Cotterean, the means pointed out by M. Persoz, in a medico-legal analysis, on the occasion of a charge of murder; the question to be determined was, whether the shirt worn by the murdered man, a blouse, and a reaping-hook, seized on the suspected party, were spotted with blood or not. After having steeped the marked objects in distilled water, and obtained the series of characteristics I indicated in 1826 in my memoir on spots of blood, we had recourse to the hypochlorous acid, and we observed—1st, that the acid applied to a part of the blue blouse, where there were no spots of any description, removed the color and whitened the place in a few moments; 2nd, that spots of deep red-brown, which were

* *Annales de Hygiène Publique.*

found on the blouse, resisted the action of the acid, acquiring a deeper color; 3rd, that the spots on the blade of the reaping-hook yielded no extract to distilled water; that they were completely dissolved in hydrochloric acid, and not affected by hypochlorous acid.

"Since this experiment I was consulted by MM. Magonty and Loust, of Bordeaux, who were charged by the authorities with the task of determining the nature of certain spots found on the lining of a waistcoat-pocket. These gentlemen had experienced some difficulty in solving the problem by the methods known at that time, and begged of me to point out to them the means of removing these obstacles. I immediately informed them that they might try hypochlorous acid, and I furnished them with every particular that might guide them in their researches. We shall see by the letter I transcribe with what ability they operated in this instance.

MM. Magonty and Loust's letter to M. Orfila:—"We should long since have thanked you for your kindness in answering our application, and pointing out a method entirely new to us, a valuable means of recognising the presence of blood on cloth, if we had not been under the necessity of repeating the experiment, and devoting ourselves to the minute researches that resulted from it. Now that our work is terminated, we hasten to inform you of the cause of our long silence; and while we beg of you to excuse it, we must express our warmest thanks to you, and inform you of the result at which we arrived.

"To verify the facts of which you informed us, not that we had any doubt of their reality, but as an indispensable task, we made several experiments by acting on linen spotted by ourselves, and we are satisfied that hypochlorous acid, prepared with chlorine, which we have not taken the precaution of previously washing, produces a very imperfect result. The spots, in fact, after a maceration of half an hour's duration become extremely pale, but still they do not entirely disappear; but the same agent freed of hydrochloric acid by washing, acts, as you informed us, only by a prolonged maceration of several hours' duration, the spot, which at first became darker and brown, became afterwards rather paler, but did not disappear.

"We now thought ourselves sufficiently informed, and we devoted ourselves to the legal investigation which the *juge d'instruction* required of us, and we were not a little surprised at seeing the spot in a great measure disappear, but still we could perceive the brownish lines that remained, as in spots of blood.

"We beg to remind you of the object of the report we had the honor of submitting to you. We were to decide on the nature of the spots found principally on the lining of a waistcoat pocket; and we then said that the physical character of these spots made us believe that they did not arise from a jet, but from contact with the stained object itself.

"We were, therefore, obliged to ascertain the difference between direct spots, that is to say, those that arise from a jet of blood, or from the immersion of the linen in that liquid, and spots which we shall call secondary, that is to say, those produced by contact with a stained substance.

"A chemical difference must exist between direct spots, that receive all the elements of the blood, and the secondary spots produced by them, when the commencement of coagulation must have fixed the principles retained by the clot of blood in the first tissue. To satisfy ourselves of the degree of credit we ought to give to this idea, we were induced to make comparative experiments on direct spots, secondary spots, and those that were the object of our researches. We consequently stained a piece of white linen with blood from the vein of a patient, and a few moments afterwards we pressed the first piece of linen on a morsel of red cloth, cut from the other pocket of the accused's waistcoat, a cloth exactly resembling that of the suspected pocket. We shall call these pieces of cloth 1, 2, 3. We placed the three pieces of cloth, nearly of the same size, in three glasses, containing hypochlorous acid, and we were able to establish—First, that the direct spot, No. 1, was acted on as you informed us; it first became brown, afterwards turned rather paler, and then remained the same, after several hours maceration. Secondly, that the secondary spot, and that on the pocket, Nos. 2 and 3, both of them partly disappeared in the same manner, that is to say, that the threads of the web, more prominent than those of the warp, and which, by contact with the spotted object, must have imbibed more of the liquid, retained a brownish hue, while the threads of the warp were colorless.

"This resemblance between Nos. 2 and 3, produced by the hypochlorous acid, we wished also to discover by the first method we had employed. We recommenced our operations, therefore, by acting comparatively on the secondary spots, and on those on the pocket, and we always obtained a similar result. After that we could no longer doubt.

"Thus, thanks to your kindness, sir, we

were enabled to employ an agent quite new to us, the correctness of which we have been able to establish, and which must for the future be of great service.

"It has also been proved to us that there is an evident difference, which no one had previously noticed, between direct and secondary spots of blood; a difference of which we think men of science, in the case of a medico-legal question, ought always to reckon upon.

"We conclude our letter as we began it, by begging of you, sir, to receive the expression of our gratitude, and to believe us your respectful pupils, &c."

I thought it was my duty to examine this question with care, to ascertain, to a certainty, whether hypochlorous acid offers the advantages that have been assigned to it by M. Persoz; for that purpose I made a great number of experiments, which it will be not useless to relate.

THE ACTION OF LIQUID HYPOCHLOROUS ACID ON SPOTS OF BLOOD.*

Experiment 1.—A piece of white linen, spotted with blood that issued from a vein, is plunged in liquid hypochlorous acid; at the end of thirty seconds the linen is withdrawn, and it is ascertained that the spot is browner than before its immersion. After seventeen hours' exposure to the air, the color was the same.

Experiment 2.—We leave a piece of white linen marked with blood, by applying it to a thick spot caused by a jet of blood, in liquid hypochlorous acid, for thirty seconds. When taken out of the liquid, the spot is rather brownish near the centre, and almost colorless at its circumference; exposed to the air this part continued to lose its color, but every part of the circumference in which the spot was rather darker, was of a clear brown color. At the end of seventeen hours the linen was dry, and of a grayish tinge, where the spot of blood was originally found.

Experiment 3.—We plunge in liquid hypochlorous acid linen marked as in the last experiment; at the end of three minutes the points which had been slightly marked with the blood, had lost their color; after ten minutes of contact three small gray flakes, alone, remained on the linen; at the end of forty minutes the last of these flakes had disappeared.

Experiment 4.—A piece of linen was spotted with poppy oil, then a slight spot of blood was placed on it. After thirty seconds' immersion in liquid hypochlorous acid, the spot became of a brown-red color, and suffered no change by long exposure to the air. But when the linen was left in the acid for an hour, the spot entirely disappeared.

Experiment 5.—A piece of white linen striped with blue, and marked two years back, with a small quantity of human blood, was plunged in liquid hypochlorous acid. At the end of thirty seconds it was taken out, and it proved to be almost entirely colorless, while the spot had still a slight shade of clear red, although it evidently had a tendency to disappear. After being exposed to the air for twenty-four hours, everything remained in the same state. The same result was attained with a piece of white linen striped with blue, and marked with a considerable quantity of blood, six years previously.

A piece of white linen, which had been marked with blood for the space of two years, was partially discolored, after an immersion of thirty seconds in hypochlorous acid; the spot became paler, and after an additional immersion for a quarter of an hour, a dirty gray tint was all that was visible on the marked part of the cloth.

A piece of black cloth, marked with a tolerably dark spot of human blood, made two years back, was partially discolored after an immersion, of thirty seconds, in hydrochlorous acid, while the spot of blood became darker, and almost black. After being exposed to the air for twenty-four hours the cloth had lost more color, but the spot retained its black color.

Experiment 6.—Pieces of black cloth, gray jean, red calico, and white linen, spotted with human blood two years back, were left for two minutes in liquid hypochlorous acid; with the exception of the red calico, which had but a very slight spot upon it, the other pieces were covered with a tolerably thick layer of blood. All these stuffs came out colorless, while the spots of blood had changed to a blackish brown. After being exposed to the air for twenty-four hours everything remained in the same state.

Experiment 7.—The coagulated blood of a pigeon was mixed with a little water, and a part of the liquid was spread upon white linen, striped with blue; after the linen had been immersed, for a few seconds, in liquid hypochlorous acid, it had lost its color, and the spot of blood, red in the first instance, had become brown. Six hours afterwards the linen was taken out of the liquid, and the spot was of so slight a brown shade, that it was almost colorless.

* The hypochlorous acid was prepared according to the plan of M. Ballard, by agitating binoxide of mercury, dissolved in water, in perfectly washed chlorine gas; the liquid is filtered when the action has ceased, and it is employed in that state, as it was by M. Persoz.

By the following day no change had taken place.

Experiment 8.—A spot of blood, recently applied to a piece of white linen, and received from a vein, was left in hypochlorous acid for the space of six hours, and at the end of that time the spot was still of a brownish black. After seventeen hours immersion, the linen was reduced to a pulp when pressed between the fingers, and nothing was seen of the spotted portion with the exception of a light gray film.

Experiment 9.—A piece of white linen, spotted two years previously with human blood, remained for six hours in liquid hypochlorous acid. The spot had changed to a dark brown, then to a light brown, and the shade of color was such, that it exactly resembled that exhibited by spots of ochre and a fatty substance, after six hours' contact with hypochlorous acid. The next day everything was in the same state.

A piece of black cloth, spotted in the same manner with human blood, after remaining six hours in the same acid, was rendered completely colorless; the spot of blood had also lost its color, the loss of color, however, took place more slowly than in the case of the cloth itself.

Experiment 10.—Pieces of black cloth, gray jean, red calico, and linen, were spotted with blood two years previously, were placed in hypochlorous acid. At the end of two hours, the cloths were completely colorless, but the spots of blood were black, and gave no indication of disappearing. After sixteen hours immersion, the red blood was of the color of *egg-nog*, but very light at the place where the spot had been; the jean was of a brownish-gray at the spotted parts, and a little fragments were visible, arising probably from the action of the hypochlorous acid on the blood, the white linen, only exhibited two undefined black points, as the remains of the original spot, these spots were about the size of a pin's head; finally the cloth which had become of a grayish brown, covered with white fragments, exhibited white tolerably dark spots, black in the centre, and of a yellowish white at the circumference.

Experiment 11.—A piece of white cloth, striped with blue, and dyed six years before with a tolerable quantity of human blood, was left for six hours in liquid hypochlorous acid; it entirely lost its colors, and the spot of blood was of an extremely light brown color.

Experiment 12.—An iron blade, which exhibited an extremely slight mark of blood, recently applied, was placed in hypochlorous acid. At the end of thirty seconds there remained, at the place where the spot had been, merely a tinge of a red brown hue; during the action of the acid a great quantity of chlorine in a gaseous state escaped, and a red oxide of iron was formed. After one hour's immersion in the same acid, the iron was covered with a tolerably thick coat of sesquioxide of iron, and when this was removed by means of a stream of water, the red brown tint, I have already mentioned, was still visible at the spot originally marked with blood. The iron blade was then placed in another quantity of hypochlorous acid, and after an immersion of five hours, the iron was covered with another thick layer of oxide; if this is removed by means of a stream of water, or by gently rubbing it with a wet brush, we may still see, here and there, small spots of a red brown color; we may say, that at these various points the oxide of iron and the resulting portions of the blood had combined together to form these marks.

Experiment 13.—After six hours' contact with liquid hypochlorous acid, an extremely slight spot of blood, recently made on a blade of iron, entirely disappeared, and the metal was completely bared.

Experiment 14.—An iron blade, with two dark spots of blood upon it, recently applied, was left for three seconds in hypochlorous acid, chlorine was disengaged, and oxide of iron formed; the spots were of a reddish brown, at the expiration of an hour, they preserved this same color, but they were detached in some places, so that the iron at these points appeared in all its brilliancy. The blade was then plunged into fresh baths of hypochlorous acid. After six hours' contact the spots were still brown in the centre, while their circumference, of a dirty red color, had a kind of little ridge, formed of sesquioxide of iron. After fourteen hours' immersion, one of these spots became grayish white, and as if incrusted with oxide of iron, the other was of a reddish brown, and peeled off in flakes; by leaving the blade in hypochlorous acid for thirty-eight hours it became thickly covered with sesquioxide of iron, and the liquid contained a large quantity of sesquichloride of iron; when the oxide was removed by means of a stream of water it was seen that the spot, which had preserved its reddish brown color, had still the same tint, but it was only attached to the blade by a few points near its centre.

THE ACTION OF HYPOCHLOROUS ACID ON SPOTS PRODUCED BY VARIOUS COLORED SUBSTANCES.

Experiment 15.—A piece of linen, spotted

black, by means of a mixture of grease and charcoal, was placed for twenty-four hours in liquid hypochlorous acid; the spot underwent no change.

Experiment 16.—A piece of blue linen, recently marked with alkanet and grease, was rapidly rendered colorless, while the spot remained; after six hours' contact, the latter, which was of a dark red, had acquired a brownish tint, resembling that assumed by the spot of blood of which I have spoken in the 9th experiment.

Experiment 17.—A piece of linen, which had been covered for a month with a large and dark spot formed of alkanet and grease, was placed in hydrochlorous acid. The linen rapidly lost its color, but the spot, at first of a blackish red, assumed the color of rust at the expiration of two hours. After sixteen hours' immersion it had lost none of its intensity.

Experiment 18.—A piece of the same linen, with a large but pale spot of the same nature as the preceding, lost its color immediately, and at the end of two hours the spot was of a yellow brown. After sixteen hours' immersion, the color had lost none of its intensity.

Experiment 19.—A piece of blue linen, marked with a spot formed of alkanet and grease, was plunged for a few seconds in hypochlorous acid; it lost its color, but the spot remained red.

Experiment 20.—A piece of blue linen, marked a month previously with grease and alkanet, was left for thirty seconds in the same acid, the linen, when taken out, was perfectly colorless, and the spot, which was thick, and of a red brown, exhibited the color of rust near the circumference, and was blackish near the centre. After sixteen hours' exposure to the air, everything was in nearly the same state.

Experiment 21.—The same experiment was repeated on a thin wide spot, made a month previously with alkanet and grease; the spot, which was reddish before immersion, was of a brown color when taken out of the liquid. After being exposed to the air for sixteen hours, the spot was of a very light reddish yellow.

Experiment 22.—A piece of white linen, spotted red in several places, with a mixture of madder and poppy-oil, was left for a few seconds in the acid; the spots were unchanged.

Experiment 23.—A part of the same linen was placed in hypochlorous acid for five hours, and the spot with which it was marked preserved nearly the same color; the next day a part of the spot had completely lost its color, and the day after no traces of color were left.

Experiment 24.—After an immersion for thirty seconds in hypochlorous acid, of a piece of white linen spotted by the *chelidonium majus*, it was proved that the faint spots had become yellowish, and the dark spots brownish near the centre. After five minutes' immersion all the faint spots had disappeared, and in the place of the dark spots circular lines were seen, of the color of rust, which, in the end, became yellow.

Experiment 25.—A piece of white cloth, colored like lees of wine, by the *campanula pyramidalis*, was placed in hypochlorous acid; at the end of thirty seconds the spots had disappeared.

Experiment 26.—A piece of white linen stained of a light bistre color in several places, and in some parts brown, by means of *taraxacum dens leonis*, was left for thirty seconds in hypochlorous acid; the bistre-colored spots, being rather faint, were entirely destroyed, the others, to the number of four, being darker, almost entirely lost their color, and at the end of thirty minutes no traces were left.

Experiment 27.—The spots made on white linen by *cichorium intybus*, are of a pale bistre color; the faintest disappeared entirely, after thirty-six seconds' immersion, and the stronger spots lost their color at the end of from ten to twelve minutes.

Experiment 28.—A piece of white linen, stained of a reddish-brown by the *lactuca virosa*, was plunged in hypochlorous acid; at the end of thirty seconds the faint spots disappeared, while the stronger became of a light yellow: the brownest of these spots was of the color of rust. The linen was exposed to the air for the space of a quarter of an hour, and then again placed in the acid; at the end of ten minutes the spot of the color of rust became white, with a tinge of yellow.

Experiment 29.—A piece of white linen, marked of a very pale reddish-brown color by *euphorbia lathyris*, was rendered colorless in a few minutes by means of hypochlorous acid.

The various spots that were the subjects of the experiments 24, 25, 26, 27, 28 and 29, where made on the 21st of August, 1842.

Experiment 30.—A piece of white linen was stained red by means of a mixture of grease and colcothar (dry sesquioxide of iron). The stain underwent no alteration, even after it had been in contact with the liquid hypochlorous acid for several days.

Experiment 31.—A piece of white linen spotted like the preceding, and not rendered colorless by the hypochlorous acid, was placed in contact with a mixture of protochloride of tin and hydrochloric acid, ac-

cording to the advice of M. Persoz. At the end of four hours the spot grew paler, seventeen hours afterwards it had nearly disappeared, for nothing was left excepting a very few spots of a pale red color inclining to yellow.

A spot of blood, as dark as the preceding, underwent no change, even after the expiration of several days, by means of the protochloride of tin and hypochloric acid.

Experiment 32.—A piece of white linen was spotted with a mixture of grease and colcothar; and the spot was afterwards covered with oil. The linen was placed in a solution of protochloride of tin slightly acidulated by hydrochloric acid. After a contact of three days the solution became extremely clouded, but the spot remained unchanged.

Experiment 33.—Rust of iron does not lose its color by liquid hypochlorous acid, even after six hours' contact.

Experiment 34.—Iron, marked with a mixture of grease and madder, does not lose its color after six hours' contact with liquid hypochlorous acid, but it does so by the following day.

Experiment 35.—Iron, well covered with a mixture of colcothar and grease, and not rendered colorless by hypochlorous acid, was placed in contact with a mixture of protochloride of tin and hydrochloric acid, at the end of twenty-four hours the spot had disappeared, and the iron had recovered its brilliancy

THE ACTION OF WATER ON SPOTS OF BLOOD.

Experiment 36.—A piece of black cloth was marked with a mixture of poppy oil and human blood. The next day the cloth was placed in water; at the end of a few minutes the liquid became red, and it could be shown to possess the characteristics of the coloring matter of the blood. A piece of linen spotted in the same manner, made the liquid red ten minutes after immersion in water, containing a notable quantity of the coloring matter of the blood.

Experiment 37.—Faint and dark spots of blood were made upon pieces of linen and cloth, previously covered with grease. Other pieces of the same linen and cloth were first spotted with blood, and afterwards covered with a slight coating of grease. The next day these different pieces of cloth were placed in water, and you could easily convince yourself at the end of a few minutes, that they yielded up a sufficient quantity of the coloring matter to the water, to enable you easily to recognise it by the action of heat, chlorine, and other agents, whose employment I have recommended in my essay published in 1826.*

Experiment 38.—A small piece of white linen, marked six years previously, with a considerable quantity of human blood, was placed in a gramme of water. At the end of a quarter of an hour, the liquid assumed a yellow tint, had a tendency to become of a red color, resembling that given to water by a very small quantity of blood; the liquid, when heated, frothed up and coagulated: chlorine and other agents acted upon it as they do on a very dilute solution of the coloring matter. If we leave another portion of the linen in distilled water for twenty-four hours, the liquid assumes a rather deeper colour, with an evident tinge of red, which, when exposed to the action of heat, undergoes the same change as that which had been obtained by contact for a quarter of an hour. The linen remains red.

THE ACTION OF WATER ON MARKS PRODUCED BY VARIOUS COLORING SUBSTANCES.

Experiment 39.—Linen marked by chelidonium majus, campanula pyramidalis, taraxacum dens leonis, cichorium intybus, lactuca virosa, and euphorbia lathyris, when placed in distilled water, gives out to it a straw color, a brown, and a blackish brown. These different liquids, when heated to the boiling point, preserve their colors and do not coagulate.

CONCLUSIONS.

1. Of all the methods proposed, up to the present day, to recognise spots of blood, that which consists in steeping these spots in water, and afterwards acting on the solution, as I advanced in 1826, is without doubt the best. M. Persoz has evidently deceived himself when he says that it often happens that spots of blood found in woven garments lose the property of dissolving in water, and cannot, consequently, be discovered by means of that liquid. Hundreds of experiments made up to the present day, and the experiments 36, 37, 38, reported in this paper, prove, on the contrary, that, in almost all cases, spots of blood, even made long since upon clean or greasy

* This process has already stood the test of time for twenty years, no experiment on spots of blood has been attempted without employing it; all those who have written on medical jurisprudence, have adopted it without modification, beginning with M. Devergie, who has inserted it *verbatim* in his work, without indicating the source from which he obtained it, and even without mentioning my name.

linen, or upon iron, give out a sufficient quantity of coloring matter to water to enable blood to be easily recognised. On the other hand, it results, from numerous experiments which I made in 1826, and from facts mentioned in this paper (see experiment 39) that all coloring matters, without exception, as well as blood, applied to linen, produce spots which are acted on in a different manner to spots of blood.

2. Hypochlorous acid is far from possessing the advantages mentioned by M. Persoz; in fact, the result of experiments 1 to 14, described in this essay, is, that the greater number of spots of blood, whether faint or strongly marked, recent or old, made upon linen or iron, entirely disappear, or almost entirely, by remaining for a tolerably lengthened time in hypochlorous acid; and that, if some of them did not entirely disappear, far from becoming of a red brown they merely left a grayish tinge behind: it is true that some of these spots, while they disappeared throughout nearly their whole extent, retained a brownish-red color in the centre.

In accordance with what M. Persoz says, if the action of hypochlorous acid does not extend beyond a few seconds, one, or two minutes, the spots of blood remain, and become brown, even when they are dry and of old date; but, as, on the other hand, under the same circumstances, spots produced by a mixture of alkanet and grease, grease and charcoal, madder and poppy oil, or chelidonium majus, &c., are acted on by hypochlorous acid in nearly the same manner as spots of blood, the result is that it is impossible to decide, with certainty, as to the nature of a spot, solely by the action of this acid, even when the immersion of the spotted part has been but of short duration. (See experiments 15 to 24.)

3. Still, however, if the hypochlorous acid is incapable of establishing positively that a spot has been produced by blood, it may, nevertheless, be employed with some advantage, as an accessory, provided it does not remain in contact with the spotted parts more than one or two minutes at the utmost: in fact, if there exist several coloring matters, besides blood, that are acted on by this acid in nearly the same manner as blood, the spots caused by these matters, although they remain, do not acquire, precisely, the same shades of color as those of blood. In addition to this, there are many coloring substances which the hypochlorous acid destroys in less than two minutes, while that time is not sufficiently long to enable this acid to cause spots of blood to disappear.

4. Hypochlorous acid is useless in distinguishing dark spots of blood on linen or iron, from spots of rust, or those produced by a mixture of colcothar and grease, because all these spots remain after a prolonged application of the acid. But if it be insufficient, in this instance, to resolve the problem, we have recourse, successfully, to the method proposed by M. Persoz, which consists in steeping dark spots of blood in a solution of protochloride of tin, acidulated by hydrochloric acid. The dark spots of blood will resist its action, while a spot produced by rust or a mixture of colcothar and grease, will disappear at the end of a few hours, unless the latter has been covered with a coating of oil.

5. The action of hypochlorous acid on spots produced by a jet of blood, or by the immersion of linen in that liquid, differs sensibly from that which it exercises on spots that may be called secondary, that is to say on those which are produced by contact with a body spotted by the jet; these last, in fact, resist in a much less degree the bleaching action of the acid.

ON SULPHARSENIURET OF LEAD, A NEW MINERAL.*

BY M. DAMOUR.

THE magnesian limestone (dolomite) of Mont St. Gothard, contains, disseminated in slender veins, a mineral, which M. Damour has ascertained to be a new species, constituting a sulpharseniuret of lead. This mineral resembles gray copper, crystallises in groups of cubes, and possesses a density of 5·479. It melts rapidly on charcoal, giving out a sulphurous odour, and afterwards the smell of arsenic, and it leaves in the end a small globule of metallic lead, surrounded by a yellow areola. Heated in a close tube, it produces a sublimate of sulphuret of arsenic, which appears at once under the form of small red and transparent drops. Hydrochloric acid acts slowly on it, disenaging sulphuretted hydrogen; boiling concentrated nitric acid attacks it rapidly, with the disengagement of nitrous vapours, and sulphur and sulphate of lead are deposited. Caustic potash acts on it when hot, and becomes impregnated with sulphuret of arsenic.

M. Damour has discovered in this mineral $As^2 Pb^4 S^5$, and, in addition, traces of silver, copper, and iron. Its composition is remarkable, on account of its corresponding with the *federers* of Rose ($Sb^2 Pb^4 S$). In

* *Journal de Pharmacie.*

the dualistic theory we should group these formulæ as follows:—

$As^2 S^3$, $2Pb^2 S$.

$Sb^2 S^3$, $2Pb^2 S$.

M. Damour proposes calling this mineral *dufrenoysite*.

EXPERIMENTS ON THE MILKY SAP OF THE COW-TREE.*

BY HEINTZ.

It is now a considerable time since the milky sap of the *palo de vaca* was examined by Messrs. Boussingault and Mariano de Rivero, who found it to contain water, wax, a substance identical with animal fibrin, sugar, and a magnesian salt, free from acetic acid.

Since the experiments of these philosophers, M. Solly also made several imperfect experiments on this liquid, according to which he discovered water; a resinous or waxy substance, gum, saline substances, probably acetate of magnesia, gluten and albumen.

Five years ago many experiments on the same subject were published by M. Marchand. This chemist found, in the sap that came from the Caraccas, water, sugar capable of fermentation, lime and magnesia in combination with phosphoric acid, traces of acetic and butyric acids, a substance resembling caoutchouc, and various resinous matters.

We have now before us a statement of new experiments, made by M. Heintz, on different samples of the milk of the cow-tree. According to this author the sap contains 42·7 per cent. of solid substances, that is to say—

Water	57·3
Vegetable albumen	0·4
Waxy matter	5·8
Resinous matter	31·4
Gum and sugar	4·7
Fixed salts	0·4

In a sample of damaged sap, M. Heintz also discovered traces of butyric acid. The ashes of the sap contained soda and traces of potash, in combination with carbonic and phosphoric acids. In addition to these substances, there were magnesia and a small quantity of lime.

These results are nearly the same as those at which the predecessors of M. Heintz had arrived. This chemist analysed, with much care, all the resinous or waxy substances he found in the sap; but it appears unnecessary for me to give the formulæ he calculated, for they are completely arbitrary, and do not apply to definite compounds.

* *Journal de Pharmacie.*

ON THE PRESENCE OF BROMINE AND IODINE IN ORGANISED BEINGS THAT LIVE IN RUNNING AND STAGNANT WATER, AND ON LAND FAR DISTANT FROM THE SEA.*

BY PROFESSOR CANTU.

Professor Cantu, in a pamphlet recently published, has shown that bromine and iodine are very frequently met with in organic beings that live in running or stagnant water, and on land far distant from the sea. These two substances are in the same state of combination, as the chlorine with which they are almost always associated. They may very easily, in a great number of cases, have escaped notice, and even in the analysis of minerals. M. Cantu has succeeded in decomposing, by the assistance of a high temperature, the chlorides, bromides, and iodurets, by means of the phosphates and arseniates, molybdic, tungstic, antimonic, and boric acids, and other oxigenated substances. The decomposition is particularly easy by chromic acid, and the chromates. Bichromate of potash would be a good test for iodine.

Already, at the ordinary temperature, the cyanurets of potassium and mercury, ferro-cyenide of potassium, and sulphocyanuret of potassium, have been decomposed by phosphoric and arsenic acids.

By the dry method, and at a high temperature, the negative principles of these combinations is decomposed by chromic acid, and the bichromate of potassium, which part with their oxygen and produce an active combustion.

M. Cantu informs us that at a high temperature, a chloride will decompose a bromide or an iodide, when the metal in combination with the bromine or iodine possesses more positive electricity than that which is combined with the chlorine.

ON THE ATOMIC WEIGHT OF CHLORINE.†

BY M. C. GERHARDT.

Since the time when chemists undertook the task of determining atomic weights, the hypothesis of Dr. Prout has been confirmed, with regard to a great number of simple bodies. This determination has, in fact, shown multiples of hydrogen, when the methods employed have been sufficiently simple and direct.

* *Bibliothèque Universelle*

† *Comptes Rendus.*

The determination of the atomic weights of of carbon, hydrogen, and nitrogen, has, in this respect, such precise results, that M. Dumas has openly declared himself in favor of the English chemist.

There was, however, an element, for which experiment had constantly given results at variance with this hypothesis; chlorine, determined successively by MM. Berzelius, Marignac, and Pelouze, has never shown a multiple in a perfect number. The results obtained by these chemists agreeing always with the number 35·8 hydrogen being equal to unity.

Struck by this circumstance, I repeated the experiments of these chemists; I operated in the same manner, by calcining perfectly pure chlorate of potash, and determining, by weight, the residuum of chloride of potassium. I took care in these experiments to observe all the precautions so well described by M. Marignac.

Several experiments, the details of which I suppress, have led me clearly to the same results, namely—

I.	II.	III.	
60·871	60·881	60·875	Residuum per ct. of chloride.

I operated upon four or five grammes of the substance, and my balance readily indicated fractions of a milligramme.

The results, as we see, are exactly the same as those of MM. Berzelius, Pelouze, and Maringac.

We shall soon find that they require correction.

I have, in fact, observed that the precautions described by M. Marignac, are not sufficient to prevent the current of oxygen gas carrying off with it a certain quantity of chloride, an extremely minute quantity, it is true, but still sufficient to affect the atomic weight of which we are in search.

I have added the following precaution to those already employed:—I adapted to the apparatus a tube bent like a U, filled with moist cotton; I then added to the tube a second tube filled with pummice-stone, and moistened with sulphuric acid. Several previous trials had shown me, that by this arrangement, the current of gas did not carry off a trace of chlorine.

In this instance, experiment, equally agreeing with the preceding, gave a weight sensibly superior to that previously obtained, the following are the results:—

I.	II.	III.
60·947	60·947	60·952

Thus, if we calculate the atomic weight of chlorine, according to these results, we arrive exactly at the multiple number 36.

I must add, that no caution was neglected to make these experiments as exact as possible; a single operation has always occupied my time for a whole day.

These experiments are another confirmation of the opinion of M. Dumas, as to the value of Dr. Prout's hypothesis.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

DR. COOPER ON THE POTATO DISEASE.*

At the meeting of the Hull Literary and Philosophical Society, on Tuesday evening, December 9, 1845, a brief but valuable lecture was delivered by Dr. Cooper, on the potato disease.

Dr. Cooper introduced the subject by stating that his object would be to point out the structure and functions of the potato plant, its chemical relations—to trace the changes which these have undergone in the present epidemic—and from these premises to infer the causes, seat, and nature of such changes. Lastly to offer suggestions as to the best mode of arresting these changes and turning to advantage the parts that remain unchanged.

Dr. Cooper expressed his belief that the disease is quite new to this country; it is not described among the epidemics of the last 30 or 40 years, nor have potato growers any acquaintance with it. It made its appearance here in the early part of August. The haulm of the potato withered, the leaves became spotted, and shrunk; and the whole field assumed the appearance of premature ripeness of the tuber. As the crops came to be raised, it was found that the tuber in many cases had undergone a change corresponding to that in the plant. More frequently the tuber was found changed, the plant healthy.

To understand the nature of this change,

* *Eastern Counties Herald.*

it is necessary to be acquainted with the natural state of the tuber, which led the lecturer into a brief description of its anatomy and physiology. The tuber is a part of the stem, not a root, as it is commonly called. It is provided with vessels and cells which are peculiar to the stem, and gives off leaf-buds (eyes). It is in fact the stem with a great development of the cellular structure of the plant, for the purpose of lodging the starch, its principal produce. Hence the tuber is composed of vessels and of cells, and the starch granules deposited in them.

Chemically the potato consists of water, starch, and gluten or albumen, with other principles not affected by the present inquiry.

The nature of the change (of which some beautifully-colored drawings by Mr. Pearsall were exhibited) is a disease affecting the tissues of the stem both cellular, vascular, and traceable, as the lecturer showed by diagrams, in the direction and position of these tissues. When examined chemically the diseased tuber is found to contain somewhat more water, though very little. Its gluten has almost disappeared, and given rise to ammonia. Its starch remains almost intact. A small quantity has been converted into grape sugar. The starch granules have no connection whatever with the diseased cells, but float loose in the water; they are enclosed in membranes or proper tunics, besides being endowed with the power of resisting external agents, and have a low degree of independent vitality. Hence they escape change.

High authorities have attributed this change to parasitical plants and animals, and observers of great name have described the kind of fungus, the mycelium of which is present in the diseased potato. But it may be remarked that the existence of fungi, which is undoubted, does not prove them to have caused the disease. They are, on the contrary, of the kind which infect other decomposing vegetable matter, or even living structures weakened by disease.

Other reasons were adduced for discarding this view, as well as that which attributed the change to purely chemical causes or rot. The change takes place during life, and affects the vital principle of the plant. It observes the laws of epidemics in its progress, and in the universality of its attack, and affects certain tissues, leaving others unaffected.

Having determined the nature of the change the cause becomes a problem of comparatively easy solution. Arguing from the peculiar character of the season, and the modifying effect of soil, moisture, and exposure of the crop, we have no difficulty in attributing the disease to atmospheric influences, aggravated by the effects of moisture and want of sun on a plant of tropical origin. Early planted crops have universally escaped the disease, and have in numberless instances kept where later crops, treated in all respects similarly, except that they have only been stored a few days instead of weeks, have altogether been lost. A sudden change in the haulm was perceived in August, after long cold, rainy, and sunless weather, and points to these, and particularly to the last, as the principal causes of the disaster.

Dr. Cooper next proceeded to offer a few suggestions on the best mode of storing and using the good and bad potatoes. "Where disease has commenced it may be restrained if not altogether arrested by dryness and exposure to air. Where it has not commenced there is no reason to fear its attack, so long as the tubers are not allowed to come into contact with one another. I am quite aware that many have been facetious in criticising this recommendation, and representing its adoption as impracticable. I am well convinced that it will be very difficult, but the occasion is worthy of every effort, and the Irish Commissioners point out how these efforts may be efficiently directed." Mr. Stickney's plan of admitting air into the pies by means of flues formed of draining tiles, was an improvement upon the plan recommended by the Irish Commissioners. Above all, everything that could favor putrefaction must be avoided, *for this will destroy more potatoes in a day than the disease would in a month.* It is thus that potatoes heaped wet in a pie or ship's hold, partly diseased and partly sound, have run into putrefaction, heated, become converted into ammonia and water, and have been turned out a totally disorganised and useless mass.

As to using partially diseased potatoes, we have seen that the disease affects the nutritious part and leaves the starch. If then, they be very far gone it will not be worth while to attempt any more than the saving of the starch, which is readily accomplished.

The instruments used for grating the plant must, however, be fine, the cells being small. Partially diseased potatoes still retain some of their gluten, which it is highly important not to waste. They should be ground up, washed in one or two waters, and the pulp made up with meal into cakes, or dried for further use. But if putrefaction has commenced, the starch alone be preserved, which is of little use

as a nutritious agent, being destitute of the all-important elementary principle, azote. The lecturer then recommended early planting of the sound sets (though he had no apprehension from sets cut from a diseased tuber).

"I do not venture on grounds so strictly practical as the question of autumn planting, so strongly recommended by the Commissioners, and adopted, I believe, by many growers both in this and other parts of the country. Suggestions have also been made as to the advantage of sprouting the potato by forcing, and planting the sprouts as early as the season and situation will allow. On this subject I may remark that one peculiarity of the diseased tubur is the great activity with which the eyes seem to vegetate, forming sprouts at this season, and in ordinary circumstances of temperature, &c., two or three inches long, and very frequently supplemental tubers also. This would seem an encouraging fact as regards the vigour and health of new sets. The use of partially diseased tubers for seed is a question which time alone can determine. On strictly chemical grounds there is no objection, but rather the reverse, to using the diseased tuber as ammonia is already formed in it, and the bud or eye is uninjured as is evidenced by its activity. Yet as this is purely theoretical no one will take the responsibility of recommending the planting of diseased tubers where sound ones were to be had. Much has been said about recurrence to the seed—I mean the true seed as found in the fruit or apple as it is commonly called. Practically there are many objections to this plan; an early crop is wanted. It is important to secure the best varieties and maintain them. And what is still more important owing to the early decay of the plant scarcely any fruit has been formed this year."

Dr. Cooper concluded with the following recapitulation of his views:—

"In reviewing the few remarks, sir, which I have thus hastily thrown together, I would impress upon my hearers the leading points which it has been my object to prove. We have seen reason to believe that the changes in the vital organs of the potato, viz., the stem, of which the tuber is a prolongation, is in the first instance a disease spreading rapidly in the fashion of epidemics over large tracts of country, and not even sparing other (Dr. Cooper showed turnips out of Lincolnshire which were affected by the disease) vegetables—that plants situated in cold wet soils and with northern aspects, are most obnoxious to it—that this disease affects the whole vascular part of the plant, and it is in the course of these vessels and in the most vascular parts, namely, at the eye end and at the insertion of the strings, that the disease first appears, ramifying afterwards in the courses taken by the vessels and cellular tissue as before indicated. The chemical changes thus produced are, the conversion of the gluten and albumen into ammonia and water, and that some starch becomes converted into grape sugar, but the great bulk remains unaltered. But if chemical changes be encouraged by heaping together tubers, some of which are diseased and undergoing chemical changes, and in all the vital principle weakened, putrefaction rapidly takes place as in other dead vegetable matter; the quantity of water increases: the starch granules are floated out of their cells, lost or losing vitality, themselves undergo fermentation. The fungi appears in the form of mould sporules, mycelium, sometimes larvæ of insects, worms, &c., but then only such as are common to all decaying vegetable matter. The means best adapted for checking further changes and such as tend to check putrefaction of vegetable substances generally, viz., dryness, exposure to air, and separation. That tuberl very much diseased will yield nutritious and wholesome food if broken down and the acrid diseased matter washed away, and the starch separated. Those that are absolutely rotten will yield good starch and some sugar from which spirit may be distilled, thus liberating for purposes of food, grain which is now worked up for the distillation of spirit. Finally, there is reason to hope that the bud of the new plant or eye is unaffected by the changes of the rest of the tuber; that in all probability it is nourished in early life by that portion of the tuber which nature has furnished in such abundance immediately around, viz., the starch, which as we have seen, is nearly unaffected, or when affected, has undergone a change analogous to malting, the first step in the vegetation of the seed, and most essential to the germinating embryo. And that early planting or sowing is much to be desired, both for securing the sprout in a vigorous and healthy state, and to furnish as early a supply of potatoes as possible for next year's consumption."

The President in a few well-timed remarks strongly advocated the expediency of autumn sowing. A friend of his, a well-known practical farmer of this neighbourhood, had for some years past experimented on this subject, and had planted potatoes in the months of October, November, December, (in January and February the ground was too hard to admit the seed), March and April. On digging, the yield of those

planted in October was found to exceed that of the succeeding month, which, in its turn, was much superior to the next, and so on. On the whole, the yield of the autumnal-planted crop was one-third greater than that planted in the spring.

Mr. Pearsall exhibited some specimens of kiln-dried potatoes; in the present instance, however, the results were not very satisfactory. The great expense attending this mode of preserving the potato would prevent any general recourse to the plan.

EXPERIMENTS ON ELECTRO-CULTURE, &c.*

On Tuesday the second meeting of the session was held, Dr. Horner, president, in the chair. The following gentlemen were announced as elected by the council:—G. J. Skelton, Wm. Earle (engineer), Cuthbert Brodrick (architect), Thomas Wilson, jun. (surgeon), James Lloyd, Geo. P. Dixon, Geo. Wells, Wm. Ostler, Thomas Freebody, Thomas Robinson, Edward Orton Ayre, Arthur Garfit, Henry Clifford, and Hans Marcher. Other gentlemen were then proposed as members of the society.

SELF-REGISTERING THERMOMETER.

The President then called upon Mr. Mansfield Harrison for a description of his newly-invented self-registering thermometer. A model of the instrument was shown (the original, from its size, weight, and permanent fixings, could not with propriety be removed from its situation). Mr. Harrison stated he used a thick bar of copper, 10 feet long, in a case, or trough of cast iron, and employs the difference of their expansion, using the direct pull of the contracting metal to obtain the force to work the levers, which multiplied the difference of expansion. Practically, he found in his instrument an expansion of 1-1260th of its length in the range of the thermometer in this climate of about 90°, and this was multiplied by levers until the space appeared to the extent of 6 inches; for this range, at the end of the second lever, was a black-lead pencil, which pressed against a cylinder turned by motion from the minute hand of a clock, and on this cylinder a paper was extended, prepared with lines and intervals, so that the pencil indicated a diagram of all the changes, day and night, for a week, upon each paper. Some instruments were then shown, which seemed formidable enough; but Mr. Harrison has been compelled to discard them, on account of the errors occasioned by the elasticity, &c., of this more slender arrangement. Mr. Harrison then spoke of the advantages of this self-registering thermometer from others in use, in which the two points, highest and lowest temperatures, only were noted; he also referred to the mean temperature annually taken from these two points, or from two or more observations daily, and showed that the mean could only be approximated from them by chance. The models, drawings, and diagrams, seemed fully to explain the instrument, and after some appropriate remarks from Dr. Horner, on the simplicity of the instrument, the completeness of the register, and the great saving of time and trouble, a vote of thanks was carried, with applause, to Mr. Mansfield Harrison, for his communication.

ELECTRO-CULTURE.

An outline was given of this experimental mode of using wires to convey electricity to an enclosed area of ground; the accounts of wondrous effects said to be produceable by these simple means went the round of the agricultural press at the commencement of the year. Mr. Pearsall had personal opportunity afforded of laying down the plans as proposed by R. D. Forster, of Findrassie, near Elgin, and he had endeavoured to follow the plan faithfully, but no effect on the electrified portion at all could be discovered during the summer and autumn. He had learned of several arrangements having been tried with similar sincerity, and with uniform want of result, viz., by Mr. Mansfield Harrison, Keyingham Marsh; Messrs. William and Joseph Stickney, near Ridgmont; W. Torr, Riby, &c., &c. He, therefore, wished to ascertain what benefit had resulted from the observations made by different observers, supposed to be from 1,000 to 2,000, who had tried it, and learn also whether the failures in the East Riding and in North Lincolnshire were owing to any want of minute attentions, or to any ill adaptation of soil, or peculiarity of climate; or, lastly, whether the failure was due to the demerits of the plan itself. He, therefore, had endeavoured to learn the results obtained from others whose efforts were conducted in a first-rate manner, and with different circumstances of soil and climate. Mr. Pearsall then read the valuable opinions he had been favored with from R. Hunt, Esq., F.R.S.; Edward Solly, Esq., experimental chemist to the Horticultural Society, London; J. Mechi, Esq., of Tiptree Hall, Essex (whose arrangement had been personally inspected

* Hull Literary and Philosophical Society. N.S., Vol. IV.

and approved of by Dr. Forster); Charles Charnock, Esq., Ferrybridge; Wm. Torr, of Riby; and other authorities. The uniform tenor was disappointment and failure. Mr. Torr was the only one who offered his results with accuracy and figures; he had carefully measured the ground, and similar areas, electrified and non-electrified, and after the utmost diligence he had obtained one peck per acre of barley in favor of the electro-culture, instead of the increase announced of 13 quarters of barley having been had, while non-electrified portions yielded five quarters, and the statement made, that "any mortal having ground, seed, and firmness of purpose, had the power of equalling this result."—(*Agricultural Gazette*, May 31.) Mr. Pearsall slightly adverted to the influence of electricity on vegetation, and while he was impressed strongly with the idea that it was the power with most economy and ease of measuring and regulation to be applied on the large scale, yet that the observations and decisions as yet left the case precisely in the same state. He then adverted to the influence of the decomposing power of the electricity over the substances, salts, and fluids of the soil, and plants; adverted to the presence or absence of light, the heat of the current itself, and the different stages of growth, as all being required to be named when advancing any views from a single or small experiment. He was not aware that any public account had been given of the results of electro-culture before, but he took this public mode of endeavouring to obtain the benefits of experience, from this handsome trial of an experiment, which had been propounded in language that afforded the practical or theoretical man no opportunity to benefit by any previous knowledge. He thought, in bringing forward these results, and adducing these high authorities, he had done something to relieve the unpleasantness arising from individual failures, and thought that these extensive and prompt trials showed that the agricultural world were active and willingly disposed to plans that were proposed with authority for general good.

The President said he was taken quite by surprise by the weight of authority adduced; he had no idea that the failure had been so complete; he had expected better things. At that time he had experiments in progress with galvanism, and he most certainly should make known the results to the society.

The Rev. Ed. Higginson suggested whether the situation of the original experiments (North Britain), and the possible level, elevation, and climate, and even the variable climate for this year, might not be some means of explaining the discrepancy.

Mr. Pearsall replied, that if the plan had been proposed with these conditions, then questions might be entertained; but the plan was given in the decided language of experience, permitting no alteration in the particular mode, referring to cases where it would be tried, and giving facts and figures, and stating any "mortal, with conveniences, could produce like results;" and it appeared that all this valuable time, and expense, and observation, amounted to something like pursuing a mistake, or hoax.

Dr. Cooper then proceeded to read his paper on the Potato Disease, and its proposed remedies, of which we have given an account elsewhere.

The thanks of the society were unanimously voted to Mr. Pearsall and Dr. Cooper, for their lectures.

SUBSTITUTE FOR POTATOES AS FOOD.*

We have been requested by several correspondents to state what kinds of food may be used instead of potatoes. In order that an efficient substitute be provided for any kind of food in general use, it is necessary that the nature of foods generally be understood. Chemical and physiological science have succeeded in pointing out the fact that there are two great classes of secretions elaborated by the vegetable kingdom that are essential to the food of man and of all other animals. The one class of these secretions contains carbon as a distinguishing ingredient, and may be called carbonaceous; the other, in addition to carbon, hydrogen, and oxygen, contains nitrogen, and is called nitrogenous or azotized.

The first class is taken into the stomach as food, and being carried into the blood, meets there with oxygen gas, unites with it, forms carbonic acid gas, and, during this process, gives out heat. This is the source of animal heat. Unless this heat is developed in due quantities, the animal perishes.

These secretions and their compositions are as follows:—

	Carbon.	Hydrogen.	Oxygen.
Starch....	12	10	10
Sugar....	12	9	9
Oil of Fat	11	14	1

These substances enter largely into the food of the whole animal kingdom. Starch

* *Agricultural Gazette*, Dec. 13, 1845.

is contained in the seeds of most plants, as of the wheat, barley, maize, rice, &c., and in the various other parts of plants used as food by man. It can easily be separated from plants, and is done so for use as food, in the form of tapioca, arrow-root, potato-starch, wheat-starch, sago, &c. Sugar is also separated from the sap and fruits of plants, in which it is so generally contained. Oil is secreted by, and separated from, a number of plants, as the Olive, Almond, &c., and is also formed from starch and sugar by the animal, and deposited in its body in the form of fat.

The nitrogenous secretions are found not only in plants but in animals. The fact is, they are simply conveyed from the plant to the animal in its food, without undergoing any change. The nitrogenous secretions form the fabric of the body. Nerves, muscles, blood, &c., are principally composed of them. Their object in food is not the keeping up of animal heat, but the nourishment, the building up of the body. It is only as food contains these secretions that it is nutritious, that it can fulfil the demand for supply by the continual waste of the body in the actions of life. These secretions, though called by different names, as fibrine, albumen, and caseine, and varying somewhat in their physical properties, are modifications of one substance, protein. Protein is composed of 48 parts carbon, 36 hydrogen, 14 oxygen, 6 nitrogen. The other substances are easily convertible one into the other, and only vary in possessing different proportions of sulphur and phosphorus, in addition to the elements of protein.

In all the food man eats he requires that it should possess, in one form or another, these two classes of secretions. The carbonaceous secretions are constantly needed in all food, to keep up the heat of the body; the nitrogenous for building up its fabric. The quantity of the latter required depends on the waste going on in the system, and when this is great, as in severe bodily exertion of any kind, the demand for them will be the greatest. As an average, it has been stated that man requires 80 per cent. of carbonaceous matters, and 20 per cent. nitrogenous. This is about the proportion of such secretions found in wheat flour, and it is undoubtedly this relation of the two classes of alimentary matters that render it the staple food of man in so large a proportion of Europe. Of other things eaten as food by man and animals, the following table, from Dr. Playfair, gives the relative quantities of carbonaceous and nitrogenous matters:—

100 parts contain—

	Water.	Nitrogenous Matter.	Carbonaceous Matter.	Ashes.
Peas....	16	29	52	3
Beans ..	14	31	52	3
Lentils..	16	33	48	3
Oats....	18	11	68	3
Barley ..	16	14	69	2
Potatoes	72	2	25	1
Turnips	89	1	9	1

It will be seen from this list how low in the scale of nourishing and respiratory elements the potato stands. It does not contain more than a fifth of the nutritive matter of oats, a tenth of wheat, and a fifteenth of peas, whilst its carbonaceous or respiratory elements are not more than one half of those seeds. It will be found, then, that although potatoes are cheap, yet in as far as they serve the purpose of food they are really as dear as any other article on the list. If potatoes are a penny a pound, and bread two-pence halfpenny, which is about the price they are in London just now, bread containing 10 times the quantity of nitrogenous matter, and twice the quantity of carbonaceous matter, is the cheaper article of diet. Bread, then, under such circumstances, may be successfully substituted for potatoes. But there are other articles on this list cheaper than wheat and its flour. Peas may be obtained at 6s. a bushel, half as cheap as wheat, and contain 15 times the quantity of nutritious matter found in potatoes. A pound of peas at 1d., and a pound of tapioca at 4d., would contain as much alimentary matter as 15 lbs. of potatoes.

The flesh of animals is composed chiefly of protein (fibrine), and is consequently more nutritious than vegetable food. It needs, however, carbonaceous matter with it, and this is the reason that potatoes, and other vegetables containing starch, are so frequently eaten with it. The tables in the *Athenæum*, in the review of an absurd book recommending a vegetable diet, referred to by "Veritas," in the *Gardeners' Chronicle* of November 22, are not now to be relied on, as they contain no distinction between carbonaceous and nitrogenous principles, and are in many points evidently incorrect. With regard to the use of blood as food, there can be no doubt of its being available for this purpose. It contains about 10 per cent. of protein, which, by proper cooking, may be made as available to the system as any other kind of food.

In the above table there are one or two

substances omitted, which might be used as food. Maize has a composition closely resembling oats and barley. It contains more oil than either; and thus, in proportion to its protein, more carbonaceous or combustible matter than either of these grains. It is the food of a large class of the community in America, although they prefer feeding pigs on it, and thus obtaining its protein and oil second-hand, in the form of pork. It may be obtained in London at about two-thirds of the price of wheat. Rice is another grain used as food. It contains only two per cent. of protein, and in this respect is not more nutritious than the potato itself. It could only be the food of an indolent people, unless it was eaten in the quantities that potatoes are in Ireland. It would, in this way, be a very expensive substitute for the potato.

There is a class of foods which are not often eaten in this country on account of their presumed indigestibility, which, however, when cooked properly, are not exposed to this objection, viz., nuts which might be eaten. All the forms of *nuts*, as the walnut, chestnut, cocoa-nut, &c., contain large quantities of oil and also starch, and protein. On account of their price, there is but one of these which could be used extensively in this country, and that is the cocoa-nut. This nut is the entire support of the inhabitants of many countries where it grows. It may be purchased in Ceylon at the rate of 12s. per 1,000. The cost of carriage could not be much, and they might, therefore, become a cheap article of diet. The average amount of meat in the nut is about 10 ounces, but we have no accurate analysis of its composition, so as to be able to compare it with potatoes or other foods. We have recently heard of a gentleman in England, who has lived on these nuts for a twelvemonth, and who finds himself in stronger and better health than ever he was in his life. This proves that such things might be eaten with safety, was there need.

Amongst the carbonaceous and nitrogenous substances used as food, there are two, gum and gelatine, which resemble the others in composition, the first belonging to the carbonaceous and the last to the nitrogenous class, but which either do not enter the blood at all, or when there do neither serve to keep up the animal heat nor to build up the fabric of the body; gummy and gelatinous substances, therefore, cannot become substitutes for the other forms of carbonaceous and nitrogenous matter. Gelatine is found abundantly in the growing parts of animals, in the skin, in the bones, and cartilages; and these parts of animals are used for making soups, jellies, &c. It should, however, be remembered, that although gelatine contains nitrogen, it does not contain protein, and it is questionable as to whether it can in any way be used as a nutritious agent. The experiments of the French Commission satisfactorily proved this. Dr. Buckland is therefore wrong when he states that bread made with powdered bones, which contain gelatine, is more nutritious than before; nor is bone-broth so nutritious as it has been sometimes regarded.

MANAGEMENT AND COMPOSITION OF MANURE.*

BY M. J. BOUSSINGAULT.

In some farms it is the practice to keep the different kinds of manure distinct. The stable manure is kept apart from that of the stall; the produce of the sty from that of the fold. Circumstances sometimes make this necessary, but the supposed advantages may be doubted, and the notions on which they are maintained depend on observations which are far from being rigorous.

Without denying the fact that certain crops flourish best with certain manures, it appears to me best to make one common heap only, where there are no local difficulties a mean quantity is thus obtained, which, in all ordinary cases, is the most advantageous. The supposed distinctions are far too absolute, and for this reason, doubtless, it is very difficult to reconcile the various accounts. Thus, according to Sinclair, pig manure is of all the strongest and richest in fertilising principles, while, according to Schwertz, it is the worst.

The truth is that manure heaps, arising from the same species of animal, differ often more in quality from one another than those which arise from various sources. The quality depends on the kind of food, the age, and the condition of the animal which produces it. It is well known that the dung of beasts in the straw-yard is far inferior to that of the stall. When litter impregnated with animal digestions is accumulated in sufficient quantity in the yard, fermentation soon takes place; the temperature rises, and abundant vapors are disengaged. As amongst these volatile substances carbonate of ammonia is one, it is important to moderate its production; this is effected by keeping the mass tolerably moist, and preventing as much as possible the access of atmospheric air. The daily addition of new litter from

* *Agricultural Gazette*, Dec. 13, 1845.

the stable contributes greatly to prevent the dispersion of the volatile principle, which it is important to retain in the manure; properly spread it becomes an obstacle to evaporation; it forms a covering which condenses the vapor, while it keeps the lower bed from too intimate a contact with oxygen. While the manure heap is managed in this way, the fermentation is confined to the lower part of the mass.

Thaer believes that air collected from the surface of a dung-heap in a moderate state of fermentation does not contain more carbonic acid than that which is collected from the atmosphere at a distance from the heap. Neither does a vessel containing nitric acid, when placed near the fermenting mass, produce those thick white vapors which are the sure sign of the presence of ammonia. The slow decomposition which it is so desirable to produce, is not easily realised, except in sufficiently compact masses, in which the manure has been spread as equally as possible. An important point is to cart out the dung before the upper more recent portions are in a state of decomposition, otherwise the whole mass enters into an active state of fermentation, and the volatile substances being no longer arrested by the upper stratum, escape and are lost in the air. A means of preventing this loss in the rare cases where it is desirable that the whole mass should be decomposed, would be to cover it with vegetable soil, which would condense the volatile matters, and itself become a powerful manure.

The dissipation of carbonate of ammonia is further prevented during fermentation by the application of salts capable of changing the ammoniacal carbonate into a fixed salt. On this account Monsieur Schastenmann, after having himself made trial of the plan, proposes to apply a certain quantity of sulphate of iron, or sulphate of lime, to fix the ammonia which is formed during the process of putrefaction. We must not, however, exaggerate the loss of ammonia in manure managed in the way we have recommended. It is, in such cases, I believe, very trifling. Gentle fermentation presents characters essentially different from those of rapid putrefaction, which never fails to take place where proper precautions are not used. I have even seen horse-manure left to itself, without any addition of water, in the course of a few days, acquire an immense heat, and take fire. I have seen it also reduced to an earthy state. Such are not the results of gradual decomposition. When the yard is cleared after a slow fermentation has taken place, the upper layer is almost in the same state as when brought from the stall or stable; that beneath it emits a slight smell of ammonia.

In the inferior strata the change is greater; the straw has lost its consistence, is fibrous, and breaks with great ease; the color is dark in proportion to the depth. Near the ground it is quite black, and smells like hydro-sulphuric acid; it contains sulphuret of iron, the sulphuret arising doubtless from the decomposition of the sulphates under the influence of organic matter. It is from this indication that I judge best whether the manure heap has been well managed. The presence of sulphurets and hydro-sulphate of ammonia need not be any cause of anxiety, for no sooner is the dung spread than they are transformed into sulphates, and it emits the musky odor which is peculiar to it. Doubtless such a condition of the manure is due to the treatment to which it has been subjected; the elements would have then another course in their decomposition had they been left to themselves. The purely ammoniacal odor developed in stables where the urine of herbivorous animals accumulates is a striking proof of the truth of this assertion.

We can easily conceive how unfavorable to the proper preparation of manure the practice, common as it is in some countries, must be of turning and exposing the manure to the air. It decomposes, indeed, much more rapidly, but it is at the expense of the quality, for it is clear, the more the surface in contact with the air is augmented, the more easily the volatile principles evaporate.

PULVERISATION OF THE SOIL.*

The grand object of pulverisation of the soil is to give free scope to the roots of plants, for without an abundance of roots no plant will become vigorous, however rich the soil may be in which it is planted. Pulverisation, therefore, is not only advantageous previous to planting or sowing, but also during the progress of vegetation of most plants.

At this stage the operator, by means of pruning, or cutting off the extending fibres, causes them to send out numerous others, by which such food as is in the soil is the more readily taken up.

Pulverisation increases the capillary attraction or sponge-like property of soils, by which their humidity is rendered more uniform. This capillary attraction is always greatest where the particles of the soil are finely divided.

* *Agricultural Gazette*, Dec. 20, 1845.

Gravels or sands retain little or no water, while stiff soils, as clays, which have not been opened by pulverisation, either do not absorb water, or when, by long action, it is absorbed, they retain too much.

Water is not only necessary to the growth of plants, but it is essential to the production of extract from the vegetable matter which they contain; and unless the soil, by pulverisation, is so constituted as to retain the requisite quantity of water to produce this extract, the application of manures would be useless.

Water is known to be a condenser and solvent of carbonic acid gas, which is immediately carried by it to the roots of vegetables. The depth of pulverisation must depend upon the soil and subsoil. In rich lands it can scarcely be too deep; and even in sands, unless the subsoil contain particles noxious to vegetables; but very dry sands, if the season is hot and dry, should merely be stirred, otherwise the great evaporation of moisture which would take place by deep pulverisation, would render them too dry for the vigorous growth of plants.

By deep pulverisation the temperature of the earth is increased. As earths are bad conductors of heat, it would be a considerable time before the gradual increasing temperature of spring could communicate its genial warmth to the roots of vegetables. It is thus of the utmost importance to have the land open, so that the warm air and tepid rains of spring may have free ingress.

Some soils are more readily heated than others, and some soils cool much sooner than others. In general, soils that consist principally of a stiff white clay, are difficult to heat, and being usually very moist, they retain the heat only for a short time.

Chalks are similar in one respect, they are difficult to heat; but being drier, they retain the heat longer.

A black soil is readily heated; colored soils, and those soils containing much carbonaceous matter, exposed under equal circumstances, acquire a much higher temperature than pale-colored soils.

When soils are perfectly dry, those which most readily become heated by the solar rays, likewise cool much more rapidly. Abundance of animal and vegetable matter, when heated to the same degree, will cool much more slowly than a wet pale soil entirely composed of earthly matter. Sir H. Davy found "that a rich black mould, which contained nearly one-fourth of vegetable matter, had its temperature increased in one hour from 65° to 88° by exposure to sunshine; whilst a chalk soil was heated only to 60°, under the same circumstances; but the mould removed into the shade, where the temperature was 62°, lost, in half an hour, 15°; whereas the chalk, under the same circumstances, had lost only 4°. A brown fertile soil, and a cold barren clay, was each artificially heated to 88°, having been previously dried. They were then exposed to the temperature of 57°; in half an hour the dark soil was found to have lost 9°, and the clay 6°. An equal portion of the clay containing moisture, after having been heated to 88°, was exposed to a temperature of 65°; in less than a quarter of an hour it was found to have gained the temperature of the room."

The moisture of the soil and subsoil materially affects its temperature, and prevents their ever attaining to any great degree of either heat or cold. As before remarked, the power of soils to absorb water depends in a great measure upon the division of their parts; the more divided they are, the greater is their absorbent power. The different constituent parts of the soil likewise appear to act with different degrees of energy. Thus, vegetable substances are more absorbent than animal substances; animal substances more so than compounds of alumina and silicia; and compounds of alumina and silicia more so than carbonate of lime and magnesia. These differences, however, depend greatly upon the state of division, and the surface exposed. Stiff clays, which absorb the greatest quantity of water when it is poured upon them in a fluid state, are not the soils which absorb the most moisture from the atmosphere in dry weather. They cake, or run together in hard lumps, and present only a small surface to the air, which requires much trouble to reduce to a fine state, and in hot dry seasons the vegetation on them is generally burnt up almost as readily as on sands. The soils which are most efficient in supplying the plant with water by atmospheric absorption are those in which there is a mixture of sand, clay, and carbonate of lime, with some animal and vegetable matter, and which are loose and light, so as to be permeable to the atmosphere. With respect to this quality, animal and vegetable matter, with carbonate of lime, are of the greatest use in soils; they give absorbent power to the soil without giving it tenacity. Sand, which also destroys tenacity, on the contrary, gives little absorbent power. The absorbent power of soils with respect to atmospheric moisture, is always greatest in the most fertile soils. When soils are immediately situated upon a bed of rock or stone, they dry sooner by evaporation than when their subsoil is of clay or marl. A clayey subsoil will some-

times be of material advantage to a sandy soil; in this case it will retain moisture in such a manner as to be capable of supplying that lost by the earth above, in consequence of evaporation, or consumption of it by plants. On the other hand a sandy or gravelly subsoil often corrects the imperfection of too great a degree of absorbent power in the true soil. In a moist climate a siliceous sandy soil is much more productive than in dry districts; and, in such situations, wheat and beans will require a less absorbent soil than in dry situations; and plants, having bulbous roots, will flourish in a soil containing as much as 14 parts out of 15 of sand. Even the exhausting powers of crops will be influenced by like circumstances; for, by means of pulverisation, the atmospheric air buried in the soil is of essential assistance (by its influence on the food of plants there lying) in the maintenance of vegetable growth. Heat is given out during the chemical processes which ensue, and hence the great propriety of cropping lands immediately after they have been turned over, and this especially if manure has been added at the same time; as the process of fermentation will go on faster when the soil is loose, and the cavities filled with air, than afterwards, when it becomes compressed with its own gravity. The advantage of heat thus obtained in exciting vegetation—whether in respect to seed or roots, especially in spring, when the soil is cold—must be very great.

There is yet an undecided point amongst many farmers relative to the best manner of laying the furrow slice. Some contend for turning it completely over, i. e., laying it quite flat; and others, that it is most advantageous to place each slice in such a manner that its outer edge may extend a little over the inner edge of the furrow which was drawn before it. In my opinion the principal objects in ploughing are to expose as much as possible to the atmosphere, and lay the land so that the harrow may in the most effectual manner raise the mould to cover the seed; these objects are the more readily accomplished by ploughing land of every description (with the exception of dry sandy soil) with a furrow slice of 7 inches deep, and about 10½ broad. The furrow slice will form an angle of about 45°. The depth of the furrow should, in general, bear a due proportion to the width, i. e., about two-thirds, or as 6 inches deep is to 9 broad. The angle 45° is strongly recommended in Bayley's Essay on the "Construction of the Plough," and in Brown's Treatise on "Rural Affairs." Ploughing previous to winter setting in is of great use to stiff clayey lands, exposing the surface to the frost, which mellows and reduces it in a manner infinitely superior to what could be accomplished by all the operations of man; the hollow place between the furrows will carry off all superfluous water, and render the soil, with the action of the winter's frost, fit for tillage earlier in spring. The harrows will also more readily take hold of the soil, and thus a proper mould will be procured for covering the seeds. Should there be any danger of the land lying too loose and hollow, repeatedly harrowing, and rolling it with a heavy roller, will furnish a remedy.

Dry sandy soils should not be ploughed in ridges, but be turned completely over and kept as level as possible. Such soils, if rendered loose and laid light by cultivation, will be greatly robbed of their fertilising particles. It is of the greatest advantage to such soils to fold sheep, or to consume the crops of turnips upon the ground where they are raised. This practice has now become pretty general over England, as it is found from experience to contribute to the improvement of such soils, not only by the dung and urine thus deposited, but by the consolidation and firmness of texture which the treading of the sheep occasions. The cultivators of this kind of soil have, therefore, many advantages over those who are engaged in the more stiff and heavy sorts of soils, in being able to perform the various operations of arable husbandry with much less expense, and being less interrupted by a wet and backward season. I have already adverted to deep ploughing, and the results to be derived from it. And, in conclusion, I would remark, that some proportion ought to be observed between the depth of the soil, subsoil, and the quantity of manure annually spread. I have witnessed where old pasture land of a sandy loam has been broken up in spring for a crop of oats by subsoil ploughing, that the crop failed. Now, there appears to me to reasons for this failure; in the first case, the subsoil brought to the surface to form the seed-bed had long been deprived of the action of the atmospheric gases, consequently must have been infertile and cold. In the second case, the dry tenacious sward being placed under the seed-bed, the moisture of the soil was quickly evaporated. The grand object of deep pulverisation is to cause the soil to retain heat and moisture, so necessary to the healthy growth of vegetables of every description.

POTATO DISEASE IN THE ISLE OF ARRAN.*

BY J. P. WHITEHOUSE.

In this island, and in many other parts of the Highlands of Scotland, and elsewhere, a disease prevailed among the potatoes for many years, but of a different description from that at present so severe here and elsewhere. It began in 1829, and continued till 1842, doing more or less damage yearly. During the first three years, there was not nearly half a crop of these roots, and the deficiency was great in general, in most places for years after; but that sort of potatoes called "Cups" was introduced from Ireland, and although the failure in this kind was not nearly so great as before its introduction, the produce of them was not great for years; still, they did not fail to produce moderate crops, while the other sorts hardly vegetated at all.

This disease, as I have said above, was very different from the present. The potatoes in the pits and houses were affected, very generally, with what was called the dry rot, the rotten parts being a dun yellowish color and dry; but it is remarkable that the eyes still retained the power of vegetating, and did grow when planted, putting up dark purple stalks about the thickness of quills, which rarely produced any potatoes under ground, but a number of small ones, of the size of peas, above it, clustered on the stalks. The same thing very often happened, even when potatoes apparently sound were planted, and the fields appeared as if only a few potatoes had been planted here and there in each drill, as the defective ones made no appearance at a little distance, though they did send up very slender shoots, as above described. This disease gradually wore away, and for three or four years past there was little appearance of its existence, although the principle of life, in most varieties of potatoes, was hardly so vigorous as it was before the disease commenced. The crop of the year before this malady showed itself was unusually great. Of course no potatoes, but for experiment, were planted, except such as seemed sound; but it often happened that those planted in the morning failed, while the same sort, cut at the same time, and planted immediately adjoining, grew well, and *vice versa*. During the prevalence of the disease, I and others imported potatoes from districts on the mainland, where the disease had shown itself; and it is remarkable that though beautiful roots, the crops from them were almost uniformly more affected with the disease than those planted with our own seed, among which it was strongly marked. So much was this the case, that we ceased to import seed potatoes, and planted only such of our own raising as appeared, at the time of planting, to be sound and good. We never plant potatoes two years in immediate succession on the same ground. So very fatal was the disease in many instances, that not a fifth part of the usual crops were produced; and as might have been expected, it produced great suffering among the poor in the Highlands of Scotland for several years. The crops of potatoes both in the present year and the last were very great in this quarter, and I understand from a number of the tenant-farmers here, that in many instances the same disease which at present affects these roots was observed last season, though not by any means to the same extent as this season.

It is therefore not entirely a new disease here. It may be observed that on the crop, a very great one, which immediately succeeded the failure, which I have shortly above described, the potatoes produced an immense quantity of seed, or, as they are called here, "bullets," and the same fact was noticed on the crop of 1844. For several years previous to 1844, there were very few "bullets" on the potatoes. I may further state that during the seasons in which the above-described disease prevailed, I raised a variety of sorts of potatoes from the seed; but as soon as they were fit for planting for a crop, the disease, or dry rot as it was called, was just as severe on them as on the potatoes from which they were raised. From these facts I hope, and would infer, that the present disease, though an extremely distressing one, will gradually wear away; as I cannot believe that any vegetable, in present cultivation, has entirely lost the power of reproduction. One of the great revolutions that have taken place on the earth's surface would, I think, be required to bring about so important a change; and if such did occur, potatoes would not alone be the sufferers.

As the most easy and likely means of preserving at least a portion of so bulky a crop as the potatoes are, the farmers here have put them up in very narrow pits and covered them with rooty turf, which they remove in dry weather, so that the tubers have the benefit of the sun and air; and remove such as appear affected with the disease. In this manner a great deal of the water contained in the potatoes will be carried off, and thus brought into a dry state, in which they are more likely to be preserved

* *Agricultural Gazette.*

sound till the time of planting. As there is little frost here, this process of drying may be continued, if found necessary, during great part of winter and spring. There are very few potatoes in this island but are affected, more or less, with the disease so common in almost every part of the empire, and in a few instances, the loss is almost total. The early garden potatoes are generally almost free of this malady.

I very much approve of planting potatoes early in winter. I did so last year, and had a very good crop. I believe that the seed is more likely to be preserved in this way than, in any other. It is advisable, however, to plant whole potatoes of the size of pigeon's eggs, or a little larger, rolled in powdered lime before planting. I followed this plan, and found it to answer well.

MODE OF MARKING AND LETTERING PACKAGES.

BY W. FRANCIS AND W. JOHNSON.

This patentee says—"The nature of our invention consists in printing a composition of glue or molasses, both of which materials is deemed necessary to elasticity and preservation) into moulds of letters, figures and devices, &c., formed on lines upon which (while in a warm state) is applied thin slips of wood or other substance, of the width of the lines, or the bevilled edges which in printing to, is drawn with the composition from the moulds; when said composition becomes properly cooled, the moulds being previously oiled, these lines which are separated between the letters, form type. The type so made are placed in the order required on a hand press formed of iron or wood or other material with wire or other springs placed at regular distances fastened on said bed, or the top or cover of which said springs are attached to blocks of wood or other material, forming a smooth level surface, on which are placed the type, and fastened by means of tapes or other ways, the springs admitting the type and blocks on which the type are placed; to play in a groove formed in the bars of the press, for the purpose of giving way when the face of the type touches an uneven surface, so as to let the whole surface of the type, and that of the package or article marked, come in complete contact with each other."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the hand press constructed as herein described, and in combination therewith, type formed of an elastic substance, composed of glue and molasses, or other material, when deemed necessary; to be used by means of said presses, with the aid of springs or other similar means, and other fixtures, as herein described, so as to ensure the successful application of the type to even or uneven surfaces, using for that purpose any material or compound that will produce the intended effect."

IMPROVEMENTS IN THE MANUFACTURE OF ARTIFICIAL STONE.*

BY P. B. WILLIAMS.

Mr. Williams employs for the base of his artificial stone, sulphate of barytes, reduced to an impalpable powder, and mixed with some flux, such as fluorspar, quartz, borax, &c. For the production of a fair specimen of white marble, we are directed to take of sulphate of barytes four parts, by weight, crown glass one part, and dried borax about one-fourth of the weight of the crown glass; these are to be finely pulverised and intimately mixed; then, placed in a covered vessel, trough, or pot, according to the size and shape required, placed in a furnace, and subjected to an intense heat. It is stated to be necessary to heat the pots before putting in the ingredients, and that every precaution should be taken to exclude all carbonaceous matters, which would convert the mass into a third refractory body, totally unworkable and useless; for this reason, the pots should not be put into the fire until it is clear, and there is no unconsumed carbon floating about, for they should be carefully covered up, and the heat be allowed to play around them freely. When the composition is completely agglutinated, or melted, which is ascertained with a trial rod, it is poured into moulds to form blocks or slabs, as may be required, and allowed to cool very gradually in a part of the furnace from which the intensity of the heat is cut off. The pots, or melting vessels, must be made of the best fire-clay, and all carbonaceous matters carefully excluded from their composition. When it is required to produce grained or veined marble, the patentee employs those metallic oxides which are not volatile, and which are used for the same purposes by porcelain manufacturers. His claim is to the production of a composition from sulphate of barytes, mixed with other materials or ingredients, such as glass, borax, and other fluxes, for the purpose of more easily fusing or agglutinating the same into a solid mass.

* *Mechanic's Magazine*, Dec. 19, 1846.

MPROVEMENTS IN WAFERS, AND IN THE MEANS OF SECURING LETTERS AND NOTES FROM BEING SURREPTITIOUSLY OPENED.*

BY JOHN FELTON.

THIS invention consists in the manufacture of four descriptions of wafers, to be used for preventing letters from being surreptitiously opened.

The first kind of wafer is made by mixing wheat-flour with five times its weight of the gum of the *phormium tenax* or New Zealand flax, and adding as much water as will reduce the mixture to a very thin paste; this paste is tinged with the required color, and poured into the tongs used for making common wafers, which have been first slightly heated, and greased with butter; the tongs are then subjected for a short time to the heat of a charcoal fire; and when removed, and allowed to cool, the composition presents the appearance of a dry cake, about the thickness of a playing card, ready to be punched into wafers.

The second description of wafer is composed of a thin solution of isinglass mixed with an equal quantity of the above mentioned gum; the mixture is colored, and is then evaporated over a slow fire to such an extent that, when cold, it will be of the desired firmness. The apparatus used for forming the composition into a flat cake consists of a plate of mirror-glass fixed in a metal frame, having a raised edge, corresponding in height with the required thickness of the composition; the plate being warmed by means of steam, and greased, the composition is poured therein, and a second plate of glass, heated and greased, is placed over it, in such manner as to touch every part of the composition, and rest on the edge of the frame: when cold, the composition is punched into wafers.

The third description of wafer is formed by coating paper, or very fine muslin, with the above mixture of isinglass and gum. The paper or muslin is stretched tightly on a frame, and two coats of the mixture are applied to each side; one coat being allowed to dry before the other is laid on, and the whole to be firm and hard before removing the material from the frame, in order to cut it into wafers.

The fourth kind are a species of fancy wafers made by applying the mixture of isinglass and gum to the under or plain side of paper, either already embossed, stamped, or engraved, and cut into wafers, or about to be treated in this manner.

The first and second kinds of wafers are cut into the shape of lozenges, and used in the same manner as ordinary wafers. The wafers made according to the third improvement are cut into rectangular shapes: when applied to a letter, the wafer is moistened, and inserted to the extent of about three-fourths of its length under the fold of the letter, and impressed firmly with a seal or stamp; and then a seal of wax is placed over the lower part of the wafer; the upper part of the wafer, left shining through the paper, is termed the "cautionary index," as the patentee presumes that no one will attempt to open a letter so secured. The fourth description of wafers are cut into the form of lozenges, and used as ordinary fancy wafers.

These wafers cannot be dissolved by water, spirit, or any other known means; nor can a letter fairly secured by one of these be opened without furnishing the means of certain detection.

The gum, above mentioned, is obtained by forcibly pulling the centre leaves of the *phormium tenax*, or New Zealand flax, from the socket that connects them with the root; this socket immediately secretes a quantity of gum, which can be collected with a spoon.

The patentee disclaims the methods, above described, of making the first, second, and fourth kinds of wafers. He claims the making of wafers of paper, cloth, or any other material, anointed with any substance or composition on both sides; likewise the rectangular form of wafers, and the method of leaving the upper part of the wafer uncovered with sealing-wax, as a "cautionary index;" also the application of the gum of the *phormium tenax* or New Zealand flax in the manufacture of wafers or instruments for preventing letters and notes from being surreptitiously opened; and, lastly—the compositions, mentioned above, of which the wafers are formed.

* *London Repertory.*

IMPROVEMENTS IN COMBINING SMALL COAL AND OTHER MATTERS, AND IN PRESERVING WOOD.*

BY FREDERICK RANSOME.

THIS invention consists in the employment of a solution of silica or siliceous cement for combining small coal into blocks or masses, and for preserving wood.

The solution of silica or siliceous cement is made by dissolving 100lbs. of crystallised car-

* *London Repertory.*

bonate of soda in as much water as will make a solution of 1·150 sp. gr. at a temperature of 60°, and the soda is rendered caustic by the addition of lime; or, instead of carbonate of soda, 50lbs. of carbonate of potash are dissolved in the requisite quantity of water, and rendered caustic by means of lime. This caustic alkaline solution is introduced, along with about 100lbs. of finely-broken flints or other siliceous substances, into an iron boiler or digester, and the mixture is kept for ten or twelve hours at a temperature of about 300°F., being at the same time frequently stirred. When sufficiently incorporated, the mixture is passed through a sieve, to remove any undissolved stone therefrom, and it is then evaporated until its specific gravity is increased to 1·500, at a temperature of 60°. The cement or solution is now fit for use; or, if too thin, it may be brought to the required consistence by evaporation, or by the addition of sand, or of calcined flints in a finely-powdered state; if too thick, it can be reduced with water.

The mode of combining small coal into blocks, is, by mixing any suitable quantity of coal-dust or small coal with from one-twentieth to one-tenth of its weight of the siliceous cement; this mixture is put into moulds, and subjected to hydraulic or other mechanical pressure; after which it is taken from the moulds, and allowed to dry at the atmospheric temperature for a few hours; and it is then placed in an oven or hot room. To effect the more perfect combustion of artificial fuel generally, as well as that prepared by the above method, the patentee forms one or more holes through each lump or block, for the free admission of air during the process of combustion; this is accomplished by inserting in the moulds one or more tapering plugs or cores, which are withdrawn after the fuel is compressed.

When treating timber, the patentee saturates or impregnates it with a solution of silica in such a manner as to cement the fibrous part of the wood with the silica, so as to form a solid and durable mass. The wood is placed in an air-tight vessel, from which as much air is abstracted as is practicable, by an air-pump or other convenient means; a sufficient quantity of siliceous cement to cover the wood is then admitted, and, in order to cause the cement to penetrate further into the pores of the wood than would be effected naturally, artificial pressure is applied, by means of a pump; when removed, the wood is immersed in some acidulated or saline solution, which will render the silica insoluble.

The patentee claims—Firstly, the cementing or combining small coal into blocks by the use of a solution of silica. Secondly, the making of a hole or holes through each lump or block of artificial fuel, for the purpose of increasing combustion. Thirdly, the cementing and preserving vegetable substances by the use of a solution of silica.

SOAP AS A MANURE.*

BY T. DALTON.

HAVING seen in some late number of your excellent paper some discussion on the value of soap as a manure, I am inclined to give you my experience in this matter.

I am a silk dyer, and use about 15 cwt. of soap weekly to discharge the gum and oily matter from the silk before dyeing. I also use about 1 cwt. of soda to 3 cwt. of soap, which I presume unites with the oily matter of the silk, forming a species of soap. The result is, that I produce from 4,000 to 6,000 gallons of strong soap suds per week; and, having a small farm, I have latterly applied the whole of this to my land, and its effect is most extraordinary. My experience in its use has been only one season, and I cannot, therefore, give any comparative results; but I consider it more powerful than any manure that I am acquainted with.

If any of your readers will do me the honor to come and see my land next spring, when vegetation begins to move, they will have ample evidence of the value of soap as a manure; and if farmers were allowed the drawback of the duty on soap used as a manure, in the same way that us manufacturers are allowed it by the government, there is no doubt in my mind that soap would soon supersede the use of guano.

P.S. There is a very large consumption of soap by the manufacturers of cloth, linen, silk, and cotton goods, and the duty is remitted to such consumers; the farmer has surely an equal claim, as he is the manufacturer of food, and they of raiment. The soap which I use on my land is duty free, because I employ it first as a manufacturer.

MANAGEMENT OF LIQUID MANURE.†

THE principle of the apparatus is a very ingenious one, by which your correspondent, Mr. Liddell, of Hull, proposes to solve your mechanical problem respecting the drainage

* *Agricultural Gazette, Dec.* 13, 1845.
† *Ibid.*

of a fold yard, but in a part of the practical details, his invention appears to me susceptible of improvement, which I proceed to point out. Your correspondent makes his float (which is the regulator of the apparatus) to rest on the fluid in the manure-tank, and consequently the degree of its efficiency is entirely dependent on the varying height of the fluid contained therein. One or other of the following results must flow from this arrangement.

1. Either a constant and harrassing attention must be given to adjusting or regulating the float on its stem, which destroys its character as a self-acting instrument; or, 2d, if this be not done, and the fluid get low in the tank, it is liable to be inundated with rain-water before the float is in a condition to act upon the stopper or valve. When the rain-water and fluid manure combined have risen to such a height in the tank as to cause the valve to be closed, the latter must remain in that situation until some of the fluid has been abstracted from the tank, or a new adjustment made, and unless one or other of these conditions be complied with, the liquid manure will be detained in the drain, and compelled to flow over into the waste pipe.

A sufficient remedy for all these inconveniences will be found by making the float to rest upon fluid contained in a separate well of small dimensions, with a graduated and narrow outlet, ample enough to allow whatever manure may enter the drains to flow off into the manure-tank without materially affecting the float, but also small enough to make it quickly sensible to any unusual addition from an influx of rain-water.

In an accompanying drawing I have represented this well, communicating on the one side with the drain from the fold-yard, and on the opposite side by a contracted outlet with the drain leading to the manure-tank, capable of being still further contracted by means of a sliding plate, which is fixed to the float by a projecting arm, and moves up and down loosely, and without friction, in raised grooves, formed parallel with the sides of the outlet or aperture. In the ordinary state of the apparatus, when liquid manure only is flowing into the tank, the upper edge of this plate is on a line with the bottom of the outlet; but when a fall of rain brings into the well a greater quantity of fluid than can flow off by the outlet in the same time, the float will begin to rise, and with it the plate, which will thus assist in restricting the efflux of water from the well, and ensure the speedier action of the valve.

It will be seen, then, that the apparatus, when once properly adjusted, is strictly self-acting, without requiring human care and attendance. In dry weather it will remain nearly stationary, with the valve open; but during rain the instrument will be under the influence of successive alternate movements, minute in degree, and regular in time. The influx of rain-water first raises the float and closes the valve, and, accumulating in the drain, flows over into the waste pipe: in the meantime, however, fluid is also escaping from the well, which lowers its level, the float begins to descend, and the valve is slightly raised, and a fresh influx of water again closes it, and thus it goes on as long as the rain continues.

This is, in effect, an apparatus for regulating the rate at which water shall enter the tank. Supposing the machine able to deliver into the tank one gallon per minute, and rain to pour on the yard equal to 10 gallons per minute, then every minute, from the very commencement of the shower, one gallon will be saved and nine wasted. But we do not want this: we want the whole of the first hour of the rain to run into the tank, because all this is a strongish decoction of the soluble matter in the yard, and, after the first hour, on the assumption that by that time the decoction is so weak, owing to previous washings, that it is not worth keeping to cart on the land, we want the whole of it to run to waste.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

AN ESSAY ON LACTUCARIUM.*

BY EMILE MOUCHON,

SINCE we have been indebted to M. Aubergier for the cultivation of the lettuce, for the purpose of extracting the lactucarium, on a sufficiently large scale to satisfy the wants of the moment, the medical use of this valuable agent surely ought to become general in France.

The thridace (expressed juice of the lettuce) of our pharmacopolists, which we

* *Journal de Chimie.*

must, nevertheless, be cautious not to consider entirely without virtue, when it has been prepared by a skilful hand, will, for the future, be destined to play a very secondary part; but without being completely neglected, if the honorable pharmacopolist of Clermont, Ferrand, who has made so many and such noble efforts to attain his end, should find sufficient imitators, to meet the constantly increasing consumption of lactucarium. The success of our brother laborer has been so great, also, that we may be well permitted to hope so good an example will not be lost upon us, however great may be the obstacles to be surmounted to realise similar results.

In his last work on lactucarium, M. Aubergier enters into very interesting details, which induce us to believe that this direct product may be utilized under the form of a syrup, in preference to every other mode of employing it. The author considering also that alcohol at 21° must be the fittest menstruum to dissolve the active principle, proposes to add to simple syrup, the alcoholic extract of lactucarium.

A proposition of this nature deserves consideration when it comes from so skilful and estimable a fellow-laborer, as M. Aubergier. In the meantime, as it bears upon an important subject, it appears to me to be proper enough to examine how far he is right, whatever confidence observations based on his experience may inspire. On this account I propose, in my turn, freely to examine the question, not, most certainly, presuming to resolve it completely, but, at least, with the intention of facilitating the solution.

And in the first place I must call attention to the fact that nothing proves that the lactucarium taken in a natural state, in pills for instance, according to the express recommendation of Doctor François, is not more active than its alcoholic extract, and other preparations of which it may be the base. Lactucarium is a complex body, it is true, but is it not to be feared that in separating its principles we may weaken its properties? If it were possible for us to procure opium in tears (the gobsar of the Persians), a product which, in certain points of view cannot be compared to anything so well as lactucarium, should we be disposed to alter its nature with the intention of rendering it more efficacious? I think not; for although this also is a complex body, it is not the less the result of a simple exudation, a milky juice, thickened on the plant itself. If the opium of commerce could, in this respect, be compared to it, none of us, perhaps, would ever have conceived the idea of subjecting it to the various transformations it undergoes in our laboratories, leaving out of the question, however, the learned chemical investigations to which we are indebted for the happy possession of the salts of morphine.

Besides, less exclusive than M. François, I am far from thinking that certain preparations of lactucarium are without efficacy; I believe them, on the contrary, to be extremely active; still I prefer the lactucarium in substance, or associated with other agents that cannot in any manner act on its principles. In my opinion it is a substance which ought, as much as possible, to be kept out of the reach of the action of heat, and be maintained in its integrity; for I am disposed to think it is easily changed by certain influences, without, however, having anything very positive to produce in support of this opinion; it is a presumption, nothing more. I press this point no further, because I do not attach to it more importance than its object deserves. Another case ought to occupy me more seriously—it is that which is attached to the question of ascertaining what menstruum is best for the treatment of lactucariums. Ought we, in fact, to employ weak to concentrated alcohol, sulphuric ether to distilled water, as M. Aubergier thinks? Such is the question I propose to examine in this paper. It is the more delicate on my part, because it may place me in opposition to a skilful brother, for whom I profess the most profound esteem. Still, as we both of us are guided by the same wish, I have every reason to believe that he will be glad I have inquired into the same subject, even if I run counter to his opinion, so long as I succeed in deducing useful conclusions.

TREATMENT OF LACTUCARIUM WITH ETHER.

Two grammes of M. Aubergier's lactucarium yielded to this menstruum 65 centigrammes of a dry substance, white, light, friable, extremely bitter, &c. Two doses of the alcohol are sufficient; a third is almost superfluous, for it has scarcely any effect on the residue. We may, indeed, strictly confine ourselves to one, for with 16 parts of sulphuric ether, the second dose only furnished 4 or 5 centigrammes of the product.

It is evident this etherial extract cannot be an agent fitted to replace the lactucarium; for the active matter, extracted on account of its soluble properties, appears in a very small quantity. Still, however, it must not be considered entirely inert; its decided and characteristic bitterness will not allow us to imagine this. It only satisfies us that the sulphuric ether ought to be rejected, when we wish to extract the whole of the active matter of the lactucarium, and while we attribute to it an action upon the same body,

although it may be feeble; this will allow us to believe that a certain degree of virtue exists in the etherolate of lactucarium; that may, perhaps, be employed efficaciously in certain cases, where the combined use of the two agents seems to be indicated. The instantaneous action of the dissolvent would enable us, in a case of necessity, to prepare this ethesial tincture extempore.

TREATMENT WITH ALCOHOL.

The dissolvent power of alcohol on lactucarium resembles that of ether in a greater degree in proportion to the greater concentration of the former. The result of this incontestible truth is that we are obliged to have recourse to alcohol at 21° as the pharmacopolist of Clermont proposes, when we wish to act upon this body by means of alcohol.

These treatments with alcohol need not be several times repeated; the first treatment carries off almost the whole of the principles that can be combined with weak alcohol. Thus, after twenty-four hours maceration, 8 grammes of lactucarium yielded to 60 of hydro-alcohol; at 21°, 3 grammes of a dry extract, of a clear brown color, while a second dose produced only 50 centigrammes; and this was almost all alcohol at that degree of concentration could extract from the lactucarium. We must add to this observation that the second product bore scarcely any resemblance to the first, although the bitterness was very decided. The alcohol of this second operation, also, had no resemblance to that of the first; it was milky white, that of the first was deeply colored, and rather clouded. A third addition of alcohol left all the matter upon which it could act upon the filter, so that the alcohol was quite milky before the filtration, and perfectly colorless afterwards. That which was left in the capsule was almost insignificant, its weight being not more than 5 centigrammes.

As to the residue, it was no longer bitter, it was insipid. But, if it be acted on by 8 grammes of ether, it makes it bitter and tenacious, and gives up so much of its substance, that 75 centigrammes of dry and almost inert matter remains on the filter. The dissolved matter that remains in the evaporating vessel, is white, friable, easily reduced to powder, and sensibly bitter. Exposed to the action of 125 grammes of boiling distilled water, it makes the liquid decidedly bitter, without sensibly clouding it. The treatment causes it to lose a fifth part of its weight. A strong heat makes it swell, then liquifies it, and causes it to burn with a flame, without leaving the least residue. Thus liquified it is extremely adhesive, and very elastic; ether alone can remove it from the substances to which it adheres; properly speaking it is caoutchouc, for it has all the properties of that body, and all its physical characteristics.

It is worthy of remark, that after having been subjected to the successive action of alcohol and sulphuric ether, this substance still gives up a fifth part of its weight to distilled water, and that it imparts a characteristic bitterness to this last solvent, without, however, causing it to lose its transparency. I draw attention to this observation, because it will assist me in my judgment when I shall have to give my opinion on the nature of the menstruum that should be employed to remove the whole of the active matter from the lactucarium.

TREATMENT WITH COLD DISTILLED WATER.

The nature of lactucarium scarcely allows us to consider cold water as a proper solvent of this concrete juice. Still the result of several trials made with the greatest care, is that it can give up one quarter of its weight of one soluble substance or another, if we have recourse to one or several macerations of from twelve to twenty-four hours duration, with 32 parts or more of distilled water.

The liquid is in that case extremely bitter, and rather milky. Its slow evaporation, in a glass capsule, furnishes an extract, but does not appear to differ from the alcoholic extract.

TREATMENT WITH BOILING DISTILLED WATER.

Of all the solvents employed in my different essays this is, evidently, the one I ought to prefer. In fact it is only necessary to place the lactucarium over the fire, until 32 parts of distilled water have boiled, to extract 60 per cent. of its weight, by squeezing the residue in a fine cloth.

The liquid thus collected is extremely bitter, slightly cloudy, and tolerably colored. The substance it leaves in the capsule has all the characters of the preceding. It is a reddish color semi-transparent, when in thin flakes, and in supportably bitter. Boiling distilled water, in sufficient quantity, dissolves the greatest portion instantaneously, and keeps the remainder suspended. The liquid, as it becomes cold, becomes a little clouded, but deposits scarcely anything. This deposit is slightly colored; but it is of little consequence, its quantity being so extremely small.

If we treat the insolable residue with a fresh quantity of boiling distilled water, we

find the same weight, after it is perfectly dry. It is the same when this body is macerated in alcohol; let the density of the liquid be either weak or strong, 21 or 36 degrees, the residue remains untouched. Sulphuric ether, alone, has an action, and a powerful action, on this residue. It carries off more than four fifths of its weight of the white substance already noticed, but to produce this effect maceration of 12 hours duration, at least, are necessary; a third has scarcely any result. The etherial liquids, the first particularly, is of a strongly marked bitter taste, which gives us reason to suspect the presence of a small quantity of the active matter. Still we must only to a certain extent take this bitterness into account, for we ought not conceal from ourselves that ether itself is sensibly bitter.

In addition to this, we may remark, that all these extracts, the aqueous extract in particular, on which heat has had most influence, possess in a very slight degree only the poisonous smell that so well distinguishes lactucarium. This appears to me to prove clearly enough, that the poisonous principle, on the importance of which we must not deceive ourselves, is partly volatilized during the operation, although the greatest precautions have been taken to preserve it in the product.

This remark is not applicable to the aqueous solution resulting from the instantaneous action of boiling distilled water on native lactucarium. It possesses in a high degree that poisonous smell, and the bitterness, that are such essential characteristics of this vegetable production.

According to all these facts, it appears to me to be most advisable to reject the alcoholic extract proposed by M. Aubergier, and to confine ourselves to the direct treatment of lactucarium with boiling distilled water.

This meustruum removes exactly 50 per cent. of the lactucarium; it would also be advisable to employ two grammes of this base, with 500 of syrup, for the purpose of agreeing as nearly as possible with the operations of our fellow-labourer. Nevertheless, I should consider it still more rational to let the lactucarium enter into the composition as a mutiple, that should come as near as possible to the same proportions, as it does in the following formula:—

Syrup of lactucarium.

Lactucarium in coarse powder, 1 gramme 70.
Distilled water ..... 30 grammes.
Simple syrup ..... 500 ,,

Place the lactucarium over the fire, along with 15 grammes of water, until the liquid boils; pour it out and press out the liquor, complete the extraction of the matter with an equal quantity of boiling water, pour out this second solution, add the two products to the boiling syrup, and reduce the whole to 500 grammes.

By this process, as simple as it is easy, you realise in an instant, a product whose characters leave no doubt as to the excellence of the medicament. The bitter taste is more decided than in that of M. Aubergier, and the poisonous smell of lactucarium is recognised in all its force.

Thirty grammes of this syrup are equal to 10 centigrammes of the base, and 5 of the extract. This is a reasonable proportion in more than one respect; the medical action of the remedy being sufficiently powerful to enable you to confine the dose to that of 15 grammes, at most, during 24 hours, and the proportional quantity of the medicine cannot be forgotten.

In addition to this, we must not forget that the stomach, according to Dr. François, soon accustoms itself to the action of lactucarium, and it is impossible to produce any sensible effect for many successive days, without rapidly increasing the doses of the medicine; being able to return to the first dose after an interruption of a couple of days. By neglecting this principle the foundation for which rests on numerous observations, we frequently expose ourselves to miscalculations, which cannot fail to raise a prejudice against lactucarium.

The conclusion to be drawn from the preceding observations appears to me to be very easy. It is evident, in fact, that there is no advantage in treating the lactucarium with alcohol, either weak or strong. Neither does the preparation of an alcoholic extract offer any thing advantageous in practice, while everything is to be gained by the employment of boiling water to extract the active matter; whether we operate for the purpose of introducing it into the syrup, or into any other officinal preparation, without having recourse to any previous concentration.

These conclusions appear to me to be the necessary corollary to the facts I have submitted to the consideration of practical men. In addition to this they seem to answer the end proposed in a most satisfactory manner. Nevertheless, it shall not be my last observation. The confidence with which lactucarium inspires me, imposes upon me, in my turn, the obligation of pointing it out as an agent of the first class, which cannot receive too much attention, in regard to the numerous counter-indications opium exhibits, for which it may fairly be considered as the best succedanium Febrile affections are those only that have been mentioned, as

contrary to the exhibition of this remedy, which must also never be administered while the work of digestion is going forward. Its sedative effects on the nervous and vascular system enables it to relieve pain by producing sleep, without any appearance of narcotic effects; it has also been remarked that it usually succeeds in cases where opium has completely failed. It is from these truths that have become trite, but which, nevertheless, cannot be too often repeated, after the miscalculations the thridace of our pharmacopolists have enabled us to place on our annals, as much perhaps from the insufficiency of the doses, as from other causes, which I must pass over in silence.

If the most celebrated physicians of antiquity, with Hippocrates at their head, never feared to place their confidence in lettuce, why should we refuse ours to lactucarium, or to thridace, now the labours of our contemporaries have placed their efficacy beyond doubt? The "plant of the Eunuchs," as the Pythagorians called it, with some reason—that which made Musa, the physician to the Emperor Augustus, worthy of a statue, has not been able to fall in the estimation of mankind; and if, in our days, there are practitioners who despise its sedative powers, it is because, in these times, medical scepticism, become systematic and too exclusive in certain minds, possesses a most mischievous influence even on the most valued agents. Extremes in all things, particularly in medicine, are extremely deplorable; but the time has not yet arrived when what is reasonable shall be right. In the meantime, if it be true, as the immortal Bacon says, "that we rise from facts to axioms," and that afterwards we redescend from axioms to practice, we must necessarily acknowledge that no agent deserves better than lactucarium the various appliances to which it has been subjected, and believe that the opinion of men of science, without any exception, will be completely in its favour.

AN ESSAY ON ALCOHOLIC TINCTURES.*

BY M. JAQUES PERSONNE.

We designate by the term alcholic tinctures, solutions in alcohol of the principal medicinal principles contained in vegetables and animals.

In these preparations, alcohol is almost always employed to hold in solution medicinal substances, and to preserve them from change. They are, therefore, medicines in which practitioners ought at all times to find the active principles, if not in the same state as they are met with in the vegetables themselves, at least in a perfect state of preservation.

The active principles that enter into the composition of tinctures are of a different nature, according to the substances by which they are furnished; some, as we know, are more soluble in concentrated alcohol, as the resins, others are, on the contrary, more soluble in weak alcohol, or in water, as, for instance, the gum resins and extractive matter. From thence arises the necessity of employing alcohol of different degrees of strength to dissolve these substances, regulated according to the medicinal principles the substances on which you operate contain.

The various degrees of strength of the alcohol, intended for the preparation of tinctures, have been chosen in a manner purely theoretical. In fact, when analysis has shown that the active portion of a substance is soluble in concentrated alcohol, we prescribe alcohol of this description in the preparation of the tincture; on the contrary, if it is proved that the active principle is more soluble in weak alcohol, the preference is given to the latter. In the case of substances on the nature of which analysis has not as yet decided, the strength of the alcohol has been chosen, in a manner that is almost empirical, basing it always upon analogy.

Relying upon these facts, the "codex" has adopted alcohol of three different degrees of strength for the preparation of tinctures, these degrees are 36°, 32° and 22° of Baume or 86°, 80° and 56° of the centesimal scale. Alcohol at 86° is reserved for substances which are loaded with fat and little soluble substances. Alcohol at 80° for substances containing various resinous principles and volatile oil, and lastly, alcohol at 56° for substances of an extractive nature.

Are these three different degrees of strength which are recommended, the most fitted for the preparation of alcoholic tinctures? several isolated experiments have thrown a doubt upon this first point.

The intention of alcoholic tinctures is also to provide practitioners with solutions of a known strength, that they may be able to calculate the relative proportions between the quantity of the tincture prescribed, and that of the substance used in its preparation.

The extremely varying nature of the vegetable and animal substances used in the preparation of these medicaments, causes us to imagine, in the very outset, that the same

* *Journal de Pharmacie.*

quantity of the vehicle cannot be sufficient to dissolve, entirely, all the principles contained in each of these substances: in that case the proportion of the alcohol ought to vary according to the quantity of soluble matters contained in the substances employed. But as it is useful that practitioners should easily remember these proportions, different authors all agree to admit but a small number. On this account the "codex" prescribes, in most cases, the proportions of four parts of alcohol for one part of the substance employed.

Are these four parts of alcohol sufficient to extract the whole of the active principles of the animal or vegetable substance employed, or does not a certain quantity of these principles remain in the substance, not being able to enter into solution in the alcohol, on account of the small quantity of that vehicle? In the first case the proportion between the alcohol and the substance employed would be correct; in the second, this proportion would not be correct; and the result of this uncertainty would be that if the practitioner should prescribe any particular dose of a tincture, he would not know how much of this tincture represented the substance employed in its preparation, how many parts it contained of the vegetable or animal matter in the solution, and consequently he would not be able to judge with certainty of its effects.

The *first*, and I should say the only attempts known for determining the real strength of the alcohol, as well as the proportional quantity to employ in the preparation of tinctures, were made in 1817, by Messrs. Cadet and Deslauriers.*

The process these able pharmacopolists employed, and which they have laid down as the best means of arriving at results as exact as possible, is divided into two distinct operations.

The first consists in completely exhausting a given weight of each substance, previously dried in stove, by maceration in cold alcohol at 36° Baume; the reduction in the weight of this substance indicates the quantity of matter dissolved by the alcohol. In performing the same operation with distilled water, we obtain the proportions of matter dissolved by the water and the alcohol, separately, and we ascertain, according to these authors, the quantity of soluble matter in a given weight that any substance can furnish.

These points being ascertained, we must have recourse to a fresh operation to determine the relative quantity of the two vehicles necessary to hold in solution all the soluble principles. This operation consists in preparing saturated tinctures, by macerating the substances you wish to operate upon in the smallest possible quantity of alcohol at 36° B., filtering and evaporating a determinate weight of the tincture, to ascertain the quantity of matter held in solution, to repeat the same operation with distilled water; then to discover the quantity of alcohol necessary to dissolve a certain portion of the extract obtained by the alcohol, and to repeat the operation with water and the extract obtained by that solvent. It will be sufficient then to multiply by the quantity of the extract furnished by the substance, the quantity of each liquid necessary to dissolve an aliquot part of the extract, to obtain the proportions of alcohol and water, the mixture of which would be proper for the preparation of the tincture.

This process, ingenious as it is, is nevertheless not exact, for it rests upon a principle the truth of which is far from being proved—a principle which, in the generality of cases, is even false.

In fact, it is not correct to say that if we macerate separately in alcohol and water a substance containing resinous oily matters, and with extractive and gummy substances, we dissolve, by means of alcohol, all the matter soluble in that liquid that the substance contains, and that it is the same in the case of water. For, in order that that might be true, it would be necessary that these matters, of a nature so distinct from each other, should exist in the vegetable in a state of complete separation.

Is it not, on the contrary, more reasonable to imagine that these substances are in a nearly complete state of combination, and, that, being thus combined, they are not separated by the separate action of each solvent? It is only in this manner we can explain the difference of the results at which I have arrived in the case of several substances, as we shall see in the account of the experiments I shall presently mention.

Thus, therefore, no sufficiently correct experiments exist to legitimatise the three degrees of strength of the alcohol recommended by the "codex."

Neither is there anything that enables us to ascertain precisely whether the relative quantity of alcohol recommended is sufficient

* (*Jour. de Pharmacie, Vol. 3, p.* 402.) I ought, however, to mention the attempts to attain the same end, made by M. Masson four, (*Bulletin de Pharm. Vol.* 1.) and those of M. Coldefey, (*Jour. de Pharm. Vol.* 2.) which consisted in exhausting the substances on which they operated, by macerating them several times in hot alcohol, &c., but time and practice have proved that the end did not justify the means.

to dissolve, entirely, the active principles of the substances submitted to its action.

It is for the purpose of removing the obscurity that exists on these two principal points, that the *Societe de Pharmacie* has mooted the following two propositions to "ascertain by precise experiment what is the most proper strength of alcohol for the proportion of alcoholic tinctures."

"What is the relative quantity of alcohol necessary to dissolve the medicaments most generally employed."

If the numerous experiments I have made do not lead to a definite conclusion, and perhaps we may give the present state of science as the reason, they will at least serve, as I believe, to dissipate to a great extent the obscurity that exists in the preparation of alcoholic tinctures, and decide definitely, in the case of a great number of them, the proper strength of the alcohol as well as the necessary proportion of that liquid to dissolve under the most favourable circumstances, and the most completely, the active principles of the substances used in these preparations.

These experiments are of two kinds :— 1. To ascertain if the proportionate quantity of alcohol employed at the present time is sufficient to dissolve entirely, or at least as nearly as possible, the principles contained in these substances, or otherwise; and to discover what is the best proportion to employ. 2. To ascertain, also, the strength of alcohol most fitted to dissolve the active principles of these substances.

To determine the quantity of alcohol necessary, our aim must be to macerate with different quantities of alcohol, then to collect the whole of the tincture, and submit it to evaporation; or for the purpose of ascertaining the weight of the diminished matters. My first intention was to employ expression to extract the tincture, but I was soon convinced that that method was insufficient; the ame operation repeated several times with the same proportions of the solvent and the substance, gave me results that differed too greatly. In fact, it is impossible so to regulate the pressure that it may be the same in all instances; in that case, there remains in the residuum a larger or smaller quantity of the tincture, and consequently of the principles; which have, nevertheless, been dissolved by the alcohol.

The following is the process on which I decided, a process which was pointed out, however, in the programme of the prize proposed by the *Societe de Pharmacie*, and which is certainly the best means of arriving at correct conclusions.

A determinate quantity of the substance was macerated for a fitting time in a given proportion of alcohol; the maceration being completed, the whole was thrown upon the filter, the amount of the filtered tincture was carefully weighed, and then evaporated in a sand-bath; then the extract obtained was dried in a stove heated to from 158° to 174° until it no longer lost weight. The weight of this extract deducted from that of the evaporated tincture, gave me the weight of the alcohol contained in that portion of the tincture: simple proportion, then, was sufficient to ascertain the total weight of the extract which the whole of the tincture would have produced.

15 grammes of cinnamon, for instance, were macerated with 5 parts, or 75 grammes of alcohol, at 80°; the weight of the tincture that passed through the filter was 27gr.·08; that of the extract obtained from this quantity of tincture, and completely dried, was 0gr.·94. Deducting 0·94 from 27·08, we obtained 26·14 for the weight of the alcohol contained in the evaporated tincture: then, the following proportion 26·14 : 0·94 : : 75 = x gives the total weight of the matters the whole of the alcohol has dissolved : x = 2gr.·69 of extract.

All these experiments were made with the same care. I always employed the same substance for each series of experiments, and for that purpose I prepared powders of each in sufficient quantity for all the operations. The maceration lasted fifteen days in each case, and to avoid any loss of alcohol during the filtration, the receiving vessel was covered with a sheet of paper fixed to its edge, having in its centre a hole just large enough to allow the tube of the funnel to pass through; the latter was also covered with a sheet of paper kept in its place by a plate of glass.

As to the means of determining the proper strength of the alcohol, it was thought proper to vary it according to the nature of the substances to be experimented on.

When the active principles contained in those substances were clearly defined and characterised, I ascertained their quantities; this I was able to do in the case of barks, nux vomica and jalap.

These quantities were ascertained in the following manner: for bark and nux vomica the tincture was evaporated in a sand-bath, and the extract obtained was treated with acidulated water, the filtered liquor was precipitated by means of sabacetate of lead, to remove feverish matters from the alkaloïd, and then the excess of lead having been separated by sulphuretted hydrogen, the alkaloïds were precipitated by means of a solution of pure tannin; it was therefore while in the

state of tannates that the quantities of the alkaloïds were ascertained.

For jalap, I extracted the resin of a given quantity of the tincture.

But if, in the case of these substances, the management was easy, it is not the same for the greater number, in which the active principles are ill defined, and possess no characteristic chemical properties. How, for example, in the case of hemlock, rhubarb, gentian, &c., can we discover whether the tincture prepared by means of alcohol at 80° contains a greater proportion of the active principles than that prepared with alcohol at 56 ?

Among these substances there are some whose properties are contained in a bitter principle, as in the case of rhubarb, gentian, and wormwood. For these substances I took two determinate quantities, prepared with alcohol of different degrees of strength, diluting them with water to discover that which required the greatest quantity of this liquid to remove the bitterness. Unfortunately there are too many substances for which this mode of investigation cannot be employed, and this was a difficulty I was unable to overcome; it was only by calculation based on the chemical analysis of these substances, that I selected alcohol of a fitting strength. The only method, in my opinion, of attaining the desired object in these cases would be to employ medically tinctures prepared with these matters, and alcohol of different degrees of strength.

The strength of the alcohols I employed were to the number of five, namely, alcohol at 90, 80, 70, 56, 45 per cent.

To make the facts I relate intelligible I will, in the first instance, lay down the following principles, to which I was guided by nearly 300 experiments made in this manner.

1. The different strength of the alcohols recommended by the "codex" are not always those which are the best to dissolve the active principles contained in the substances employed.

2. The proportion of four parts of alcohol for one of the substance, adopted by the codex, is scarcely in any case sufficient to dissolve, entirely, the soluble matters of those substances.

3. The proportion of alcohol necessary completely to exhaust these substances, is five parts of alcohol to one of the substance employed. In two or three cases, however, four parts of alcohol are sufficient, but it is useful, I think, considering the small number of the exceptions in general, to adopt five parts of the solvent.

4. The proportion of alcohol is always sufficient when it well covers the matters submitted to its action, when these matters are herbaceous, as leaves, but in other cases it is not enough.

I must observe, that whenever the difference between the quantity of the matter dissolved by the alcohol of the strength prescribed by the "codex," and that I have employed, has been so trifling as to be insignificant, I thought it right to adhere to the strength recommended in that formulary, to avoid almost useless changes.

EXPERIMENTS.—1. YELLOW BARK.

							gr.
1 pt. or 15 grs.	by	60 gr.	or ¼ pts.	alcohol at	80°	total, ext. of tinct.	1·63
,, ,,		75 ,,	5 pts.	,,	80 id.	,,	1·55
,, ,,		id. ,,	id.	,,	id.	,,	1·59
,, ,,		90 ,,	6 pts.	,,	id.	,,	1·47
,, ,,		75 ,,	5 ,,	,,	70°	,,	1·42
,, ,,		60 ,,	4 ,,	,,	56°	,,	1·43
,, ,,		75 ,,	5 ,,	,,	id.	,,	1·74
,, ,,		90 ,,	6 ,,	,,	id.	,,	1·68
,, ,,		75 ,,	4 ,,	,,	45°	,,	1·50
,, ,,		90 ,,	6 ,,	,,	id.	,,	1·78

The quantity of the alkaloïds was ascertained in the manner I have already described.

150 grammes of the tincture, with 1 part of bark to 5 parts alcohol at 80° weight of pricipi ..... 2·451

150 grains of tinct. with 1 pt. bark and 5 pts. alcohol, at 56° ..... 0·696

The first calculation made under different circumstances, gave for alcoh. at 80° 1·797

And for alcohol at 56° ..... 2·641

We see, by these results, that alcohol at 80°, although it does not contain the largest quantity of extract, removes, however, a much larger amount of the active principle than weaker alcohol.

The preference ought, therefore, to be given to that degree of strength; besides, five parts of the solvent being the proportion that gives the most extract, that proportion ought to be adopted.

2. RED BARK.

							grs.
1 pt. or 15 gr.	by	60 gr.	or 4 pts.	alco. at	80°	total ext. of tinc.	1·97
,, ,,		75 ,,	5 ,,	,,	id.	,,	2·42
,, ,,		90 ,,	6 ,,	,,	id.	,,	2·37
,, ,,		75 ,,	5 ,,	,,	75°	,,	2·05
,, ,,		60 ,,	4 ,,	,,	56	,,	1·98
,, ,,		75 ,,	5 ,,	,,	id.	,,	2·31
,, ,,		90 ,,	6 ,,	,,	id.	,,	2·26
,, ,,		75 ,,	5 ,,	,,	45°	,,	1·99

QUANTITY OF THE ALKALOID.

150 grs. of tinct.	made with	1 pt. bark	and 5 pts.	alco. at 80°	precip. 1·346
150 ,,		,,	,,	56°	,, 1·394

We perceive that, in contradiction to what took place in the case of yellow bark, alcohol at 56° dissolves more of the active principle than alcohol at 80. I therefore, prefer alcohol at 56°; and as five parts give a larger quantity of extract than four, I adopt the proportion of five parts of that solvent.

3. GRAY BARK.

							grs.
1 pt. 15 gr.	by	60 gr.	or 4 pts.	alco. at	80°	total ext. of tinc.	2·69
,, ,,		75 ,,	5 ,,	,,	id.	,,	2·89
,, ,,		60 ,,	4 ,,	,,	56°	,,	3·21
,, ,,		75 ,,	5 ,,	,,	id.	,,	3·15
,, ,,		90 ,,	6 ,,	,,	id.	,,	3·07
,, ,,		75 ,,	5 ,,	,,	45°	,,	2·87

QUANTITY OF ALKALOID.

150 gr. of tinct.	made with	1 pt. bark	and 5 pts.	alco. at 80°	precip. 1·102
150 gr. ,,		,,	,,	56°	,, 1·795

These results are again the reverse of those obtained with yellow bark; here once more it is alcohol at 56° that dissolves most of the active principle. This experiment agrees with the result M. Guibourt obtained in 1818, when the Codex of that year was edited, by ascertaining the action of alcohol at different degrees of strength on gray bark; he found, in fact, that the residue of the gray bark treated by alcohol at 80° still remained bitter, while that which had been treated by alcohol at 56° was insipid.

I should, therefore, give the preference to alcohol at 56°, as the Codex does, and although four parts of this solvent are, as we see by the table, sufficient to dissolve all the soluble matters, I should adopt the proportion of five parts to get rid, as I said above, of these few objections.

We are struck in the very outset with the difference of the results obtained with yellow bark and the two other varieties used; we may ask ourselves the explanation of this anomaly. The most plausible explanation appears to me to be the following; yellow bark, as we see by the last experiments made with it, is that which yields the smallest quantity of extract to alcohol of various degrees of strength—containing consequently fewer extractive or other matters, enveloping the active principle; this last is found in immediate contact with the concentrated alcohol, which is its best solvent; while in the case of the two other varieties of bark, these extractive matters, which are found in greater quantity, are coagulated by the concentrated alcohol, and thus shield the active principle from the action of the solvent. We see, in fact, that in the case of the red bark, which furnishes a smaller amount of extract that the gray bark, the difference between the quantity of the alkaloïd dissolved by strong and weak alcohol is small, while it is considerable in the case of gray bark, which furnishes the greatest quantity of extract.

May we not, also, admit the existence of certain principles, at present unknown or badly defined, more or less soluble according to the species of bark to which they belong, principles that will either hinder or assist the solution of the active principle? Notwithstanding the progress of organic chemistry, this science is not at present sufficiently advanced to enable us to understand the composition of organic bodies, and consequently prevent our laying down this hypothesis.

(*To be continued in our next number.*)

ON THE THERAPEUTIC EFFECTS OF NITROGEN IN TYPHUS FEVER.*

BY JOHN GRANTHAM.

UNDER certain influences, a morbid poison is generated by the vegetable kingdom, which is capable in two ways of becoming a cause of disease to man, namely, by entering his respiratory organs with the air which he breathes, and being thus absorbed into the system, and secondly by its admission into the alimentary system, in combination with his food, and thus involved in the function of assimilation. A third mode may be recognised, when the vegetable poison has communicated disease to animals forming the food of man. Malaria is the product of a putrefactive action amongst vegetables, and this agent admitted into the tissues of man, gives rise to a similar putrefactive action in his blood; the abnormal matters resulting from such putrefactive action requiring the aid of the alimentary canal, the kidneys, and the skin, for their separation and removal from the system. Dr. Heule, in pursuing a pathological investigation of fevers, endeavoured to establish as a fact that the material of contagion is composed of organic matter. He says, "contagion is, as it were, miasma in the second generation, a miasma which has passed through the first epoch of development within the living body;" on the other hand, Dr. Cullen remarks that the foundation of a fever is laid in a debility of the whole system, and particularly in the atony of the extreme vessels. After a detail of many facts in proof of his reasonings, he concludes, "Upon the whole our doctrine of fever is explicitly this:—the remote causes are certain sedative powers applied to the nervous system, which, diminishing the energy of the brain, thereby produce a debility of the whole functions, and particularly in the actions of the extreme vessels. Such, however, is at the same time the nature of the animal economy that this debility proves an indirect stimulus to the sanguiferous system; whence, by the cold stage and spasm connected with it, the action of the heart and larger arteries is increased, and continues so till it has had the effect of restoring the energy of the brain, of extending the energy to the extreme vessels, of restoring their action, and thereby especially overcoming the spasm affecting them; upon the removing of which, the excretion of sweat and other marks of relaxation of excretories take place. Dr. Holland, in his Medical Notes and Reflections, ascribed the cause of cholera to animate contagion, which he supported by a number of lucid arguments and fair deductions from analogies. I subscribe most cordially to the doctrine laid down by Dr. Holland, and I would call especial attention to the instance which he adduces of cholera, in consequence of the great similarity of that disease and typhus abdominalis. The latter disease I observed with unusual severity in Lincolnshire and Nottinghamshire, about the year 1818, when it raged with such violence that I have seen the stage of collapse with distension of the abdomen within twenty-four hours from the attack of fever, which always commenced with diarrhœa, and death almost inevitable, despite of the most active treatment. It must be evident to all medical observers, how varied the practice of treating patients in typhus fever has been, and it is no less perplexing to read the many theories which have from time to time filled the pages of medical literature, all, however, demanding attention, and not to be lightly regarded. It is therefore with diffidence I offer my mite of experience in reference to the theory and practice of typhus fever.

The extraordinary effects of nitrogen in suspending the comatose effects of typhus fever, was so powerfully impressed on my mind during the last year, that I feel it to be a duty to promulgate the doctrine of diluting the system of fever patients with nitrogenized matter, as one of vast importance. In treating this subject, I shall, in the first place, take notice of the blood in typhus fever, the vital action of the capillaries, the constituent elements of the excretions; and lastly consider the treatment indicated in this disease.

Every part where bloodvessels are to be found, every part where nervous influence is perceptible, every tissue in the whole body, in fact, wastes away, and passes eventually from the system as useless. Where no means are at hand for repairing these daily and hourly losses, the individual must perish; the various constituents of the body giving way successively in the following order:—first, the fat; secondly, the muscles; and lastly, the substance of the brain, followed by derangement of the intellects and death. Food which is suited to arrest so fearful a state as this must contain those substances which are capable of being employed in the renewal and repair of the body, which have the same chemical composition as the body itself, or, in other words, which possesses the same constituents as the blood. There are but three proximate organic principles which are known to come within these terms, namely, albumen, fibrin, and caseln. I now proceed to state what are the constituent elements of blood in

*Medical Gazette, Dec. 12, 1845.

fever. According to Jennings (as reported in Mr. Ancell's Lectures on Physiology), "the blood in the first stage of typhus fever (depression) is generally thick and dark; it coagulates rapidly, and forms a soft large dark-colored clot. In the second stage (excitement) it flows readily, is of a scarlet color, does not coagulate so quickly as, and forms a more solid clot than, the former; it is occasionally covered with a slight buffy coat. In the third stage (collapse) it flows very readily, is thin, watery, and of a dark color; the clot is loose and flocculent, and occasionally appears more as a sediment of coloring matter than as a clot." In thoroughly developed typhus, Dr. Armstrong found the blood of the temporal artery as dark as that of the vein. Dr. Clanny also states that the watery portion of the blood increases with the intensity of the disease, and that not merely the solid constituents generally, but also the salts and carbonic acid, are diminished. The water begins to decrease, and the solid constituents to increase, in favourable cases, after twelve or eighteen days. According to Stevens, the salts of the blood (especially the chloride of sodium) are diminished in typhus fever. Dr. R. Clanny also states that the quantity of salts is materially diminished in typhoid blood. The fibrin is found decreased in the blood of typhus fever, and the decrease is in proportion to the advancement of the disease, while in inflammatory fever it is just the reverse. In intermittent fever the blood corpuscules are below the normal standard, so that, as the fever degenerates into the typhoid form, the blood corpuscules and solid constituents evidently decrease. The blood, according to Simon, in typhus petechialis putridus "is watery, very poor in fibrin, and of a dark color. If any clot be formed it is diffluent and very soft, the serum is frequently of a deep yellow, or brown red color, partly from the coloring matter of the bile, and partly from dissolved hæmato-globulin. It possesses a very peculiar smell, which probably differs in each disease." It is by no means improbable that this smell may be produced by a volatile salt of ammonia.

Hence the blood in typhus fever is very deficient in fibrin and blood corpuscules; in intermittent fever, also, the blood corpuscules are below the normal standard. In typhus fever the albumen is diminished, and a salt of ammonia is sometimes found in the blood. These are all so many evidences of an imperfect action in the laws of assimilation in fever. While in health, in men of strong constitutions the blood corpuscules are more numerous than in feeble and lymphatic temperaments. Now, the red particles of the blood should in health contain 99 parts of ammonia (animal matter?) and one of ashes, and if we refer to Dr. Prout's statement in reference to the composition of the staminal principles of the body, we find them to be composed of ultimate elements, in the following proportions:—

	Carbon.	Hydrog.	Nitrog.	Oxyg.
Albumen	50	7	15	20
Gelatin ..	47	7	16	27
Fibrin....	53	7	19	19

These considerations show the importance of regulating the supply of such elements as will neutralise the destructive action of oxygen in the blood of patients suffering under typhus fever. The necessity for the consumption and reproduction of the blood corpuscules has never yet been disputed, but various theories have been propounded by different physiologists regarding the seat of their formation, and their mode of organic development or metamorphosis. Schultz, for example, considers the blood corpuscules are formed in the lymphatic glands and conveyed by the thoracic duct into the blood. He states that the chyle which is found in the vessels issuing from the glands contains clear round oily vesicles and granular lymph corpuscules. Although the lymphatic glands may be regarded as in some degree the seat of formation of the blood corpuscules, it must by no means be supposed that the latter issue from those glands in a perfectly developed state; their ultimate maturity is obtained in the blood-vessels, and is without doubt effected by the organs of respiration, and this opinion is supported by Schultz. The great quantity of matters abounding in nitrogen and carbon, and urea, uric acid, bile, mucus, and fat, which are constantly being secreted in the urine, fœces, and mucous discharges, together with the considerable amount of carbon which is given off as carbonic acid in the process of respiration, must all be refunded to the system by the blood.

The seat of fever I consider to be the capillary structure; it is in this structure that all the phenomena of secretion and nutrition are performed, and by the superior force of the chemical law over the vital principle. The capillaries are the seat of waste and diminution of structure and power in the body. The latter, as is well known, is an effect universal in fever. If there be one symptom more characteristic than another in fever, it is the wasting of the structures of the body; the wasting always taking place in the order in which oxygen is said to act on the body when not diluted by a due supply of hydrogen or nitrogen. Simon, in

his chapter on the metamorphosis of the blood, makes the following general remarks: —"all our conceptions of organic life are associated with the idea of continuous change of substance," therefore the blood is not the only portion of the body that undergoes this change, every organ and tissue is subject to the same, which is presented to us under the general phenomena of nutrition and consumption (or waste), and which is dependent on, and effected by, the blood alone. But since the various tissues present a different chemical composition, and since the different organs separate different matters from the blood, it is obvious that they cannot all modify the circulating fluid in the same manner; but that the metamorphosis must vary in some degree with the influence of the nervous system; consequently, circulation and respiration, so as to bring the blood in contact with oxygen, are necessary for this metamorphosis, and the more completely these functions are performed, the more perfectly will the due changes of the blood be effected. The perspiration in health is an albuminous fluid excreted from the skin, containing carbon, azote, and hydrogen. The quantity perspired from a well-grown adult is estimated at two pounds in twenty-four hours. There can be no doubt but that the skin produces similar changes to the lungs: and that it is also an organ of absorption. Berzelius considers the cutaneous secretion to be composed of an acid; probably the acetic or lactic acid (he says they are nearly identical), a muriate of potash, soda, acetate of soda, and, perhaps, albumen. That which evaporates is mere water. This important excretion also demands our attention. In typhus fever it is generally, indeed I might say invariably, suppressed in the commencement of that disease, and, as a consequence, the blood is still further impeded in its assimilative action, presupposing the cappillaries and lymphatic glands to be the seat of typhus fever. The skin in health throws off lactic and butyric acid, which when suppressed, are most likely carried away by the kidneys, in the form of urea, or urate of ammonia, or uric acid. Moreover, it is a fact which I may mention in support of this opinion, that all patients who suffer from gout have a dry skin, a fact which sufficiently establishes the theory, that any obstruction or cessation of action of the organs of perspiration is rectified by the exertion of some abnormal power in the kidneys. When fever has not degenerated into typhus, the perspiration is highly acid, whether this be acetous or lactic I cannot determine. In typhus fever the odour from the skin is sufficiently cognizable to warrant the assertion of its being the effects of ammoniacal decomposition.

The saliva is the next nitrogenized element which is suppressed in typhus fever, and, in consequence, the animal heat with the means of deoxygenation in the stomach is impeded. In the *Gazette Medicale* of Feb. 8th, 1845, is a communication from Mr. Turck on the chlorides occurring in albuminous fluids, he remarks, "all the albuminous liquids he has yet examined, viz., the saliva, serum of the blood, and white of eggs, are continually disengaging ammonia." He conceives this gas is due to the simultaneous presence of muriate of ammonia and caustic soda in these fluids. The soda becomes converted into a muriate, and ammonia is then slowly liberated; therefore, he concludes that the evolution of ammonia from albuminous liquids performs an important part in the animal economy. Enderlin "concludes that the saliva, like the blood, contains no lactate, carbonate, or acetate, but that its alkaline reaction is due to tribasic phosphate of soda, which serves also as the solvent of the mucus and proteine compounds." Contemplating this secretion in health, it must be observed how great is the loss to life when it is suppressed or suspended; it is not only necessary for the first admixture with the food, but it is constantly poured out for some important duty into the stomach, when chymification is not going on.

The next secretion is the urine. The kidneys perform a high office in the animal economy, in the elimination of abnormal elements from the blood in disease. The natural properties of urine are too well known to need restating. Authors have differed much in reference to the alkalescence of urine in fever,—without doubt, the escape of the phosphates in urine, with the carbonate of ammonia and urea during the progress of typhus fever, is very general. In conclusion, I assert that ammonia, or nitrogen, is deficient in every structure as a staminal element in typhus fever; that carbon is found in larger quantities than in health in all the excretions. In typhus fever, oxygen acts by accelerating the heart's action, and depressing the nervous influence or vital power. Ammonia acts by stimulating the capillaries of the intestines, is absorbed by the lymphatic glands, and assists in the elimination of carbon from the body, and finally passes off in the compounds of the urine. The kidneys compensate for the defective function of the skin and salivary glands, by discharging matter combined with nitrogen. In typhus fever, I consider it is impossible to alter the duration of the disease. Venous congestion, wherever it may

be found, should always be relieved by depletion, either generally or locally, despite of a feeble pulse. After giving a full dose of castor oil, the carbonate of ammonia, with tincture of opium, should be persisted in, namely, ten grains of the former with ten drops of the latter, every six hours, for an adult, until the return of cerebral action, or cessation of stupor with delirium, and no longer, as at that time, aperients with quinine appear to be indicated. Friction to the skin with hot lard, after ablution with warm water (96 degrees Fah.) is of the greatest benefit; as oil is absorbed by endosmosis through the veins without immediately reaching the blood; when imbibed, it combines with the albumen of the plastic constituents to form cells, which pass into the veins and serve for the nutrition of the body, and also to regulate the animal temperature. Dr. Willis read a paper before the Royal Society, "on the special functions of the skin," wherein he showed the influence which the dissipation of a certain amount of simple water by the sudoriparous glands exerted upon the current of blood returning from all the peripheral parts of the body to the heart, and insisted upon this as the means by which venous endosmose or absorption was chiefly secured showing the power of absorption and exudation in that structure.

In reference to the diet, I consider water as the first and most important requirement of the blood, in consequence of the great evolution or production of carbonic acid; secondly, good beef tea, highly seasoned with spices, and salt with barley-water or gum-water: this diet to be given during the exhibition of the ammonia and opium; when quinine is indicated, then I would recommend port wine in addition to the above diet, and gradually return to a solid diet. On a general review of the foregoing observations, the most prominent symptom in typhus fever appears to be waste of the structures of the body, not simply attributable to the superiority of chemical over the vital action, but to more remote causes, viz., the quality of the air respired, and the quality and quantity of the food digested (as abstemiousness in animal food is considered beneficial by those whose experience has been great, especially in tropical climes: they observe that the less the inhabitants partake of an animal diet, the more exempt are they from fever); and the question arises, are these causes acute or chronic? I should say, decidedly chronic. It appears impossible to conceive typhus fever occurring suddenly when the blood is in a healthy state and the brain active. Experience fully attests the languor and debility of the system during the premonitory symptoms of typhus fever. In the year 1827, when an epidemic fever of a typhoid character made its inroad along the banks of the Thames, especially in the parish of Plumstead, Kent, when the drainage was very bad, and the disease was very fatal, the premonitory symptoms were attended with great prostration of strength, with mental depression, a livid appearance of the lips, and also of the nose, dulness of the eyes, and torpor of the excretions. I had learned that moderate measures failed in arresting the attack, therefore I ordered hydr. sub. muriatis gr. x. pulv. jalapæ ʒi. to be taken every three hours until a copious fæcal evacuation was produced, after which action the sensorium became relieved, and an intermittent form of fever ensued about the second day after the action of the aperient, proving the necessity of early attention to congestion of the liver and intestines during the premonitory stage of typhus fever.

REVIEW.

THE LADIES' MEDICAL FRIEND; Or, a Guide to the Treatment of those Diseases incident to Females from an early period, with advice to Mothers on the Management of Infants. By W. Hamilton Kittoe, M.D. London; Sherwood, Gilbert, and Piper.

At a first glance we were inclined to consign this volume to our lumber heap, but on a closer inspection we found it a valuable digest of all that has been published on the subject. Females of every grade will find it a useful monitor, and to the student and junior practitioner it may prove a remembrancer in the hour of need. Such a treatise has been long called for. Doubtless, numbers of talented works have been published on the diseases of females, but they have been either too technical, or so loose and indelicate as to render them unfit for the perusal of modest women. Dr. Kittoe's work may be justly termed "every woman's book." The articles on pregnancy, training, the skin, teeth, hair, and preservation of beauty, afford a fund of useful and original information, and the copious appendix of prescriptions renders it invaluable to mothers of families and governesses. In a word, every woman who would know something of the ailments incident to her sex, should purchase this useful treatise.

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THE CHEMIST.

I. CHEMISTRY.

ON THE EMPLOYMENT OF IODINE TO DISTINGUISH MINUTE MARKS OF ARSENIC FROM MARKS OF ANTIMONY, IN MEDICO-LEGAL INQUIRIES.*

BY M. LASSAIGNE.

In certain medico-legal inquiries, in cases of poisoning by arsenic and its compounds, we often have to form an opinion on so minute a quantity, that it is not always easy to subject it to the tests made use of under such circumstances; or, at least, the effects resulting from the reaction are, in many cases, more or less equivocal.

A clear and well-defined reaction, manifested on the smallest spots, adhering to porcelain vessels, in which they have been deposited, would, as it appears to us, be of great utility, particularly when it is not possible by any other method to decide on their real nature. The new species of reaction we now propose, and which we submit to the examination of chemists and toxicologists, does not prevent our acting on the products we obtain, by means of other agents now in use, which serve, in some measure, as a check upon our method of experimentising.

The process to which we have been conducted, after many trials, consists in exposing marks of arsenic or antimony to the action of the small quantity of vapour formed by iodine at a temperature of from 54° to 57°. The first marks experimented on, arsenical, became of a pale-yellow brown color, which changed to a lemon-yellow in the air; in a very few minutes this color afterwards disappeared by exposure to air, or to a gentle heat. The second, or antimonial marks, placed under the same circumstances, became of a deep *carmelite* yellow, and this by exposure to air passed into an orange, and then remained unchanged. To produce this reaction, which takes place at the ordinary temperature in less than from 10 to 15 minutes, the porcelain capsule, on which the marks produced by Marsh's apparatus are found, must be reversed in a saucer, in the centre of which a small quantity of dry iodine, in lamellated crystals, is placed.

Small porcelain capsules, of 0m·025 in diameter, and 0m·020 in depth, are very convenient for effecting this reaction on small narrow spots of little thickness.

As we have observed above, the yellow spots produced by the iodination of the arsenic disappear, by degrees, in a humid atmosphere; when this disappearance is complete, if we pour into the capsule in which they exist a concentrated solution of hydro-sulphuric acid, other spots of a pale lemon-yellow color will appear where the original marks existed, resulting from the transformation into yellow sulphuret of arsenic of that part of the arsenious acid that was produced by the action of humid air on the ioduret of arsenic. These fresh spots, of the same size as the first, but of another nature, instantly disappear by pouring on them a weak solution of ammonia by which they are dissolved.

The iodurettted antimonial marks do not disappear by exposure to the air; placed in contact with a solution of hydro-sulphuric acid to convert them into sulphuret of antimony, of an orange-yellow color, they resist, for a moderate time, the action of weak ammonia, which affords another characteristic serving to distinguish them from arsenical spots.

Although the results we have described are well defined and characteristic, we have made other experiments, by acting directly on arsenical and antimonial spots with liquids containing either free iodine in solution, or partly in combination. By the manner in which this substance acted, we have also been enabled to establish so clear and decided a distinction, that we now give the results with a certain degree of confidence.

The alcoholic solution of iodine acts at once upon spots of arsenic, which it instantly dissolves, and produces, by evaporation in the open air, a lemon-yellow mark of greater or less extent. The marks of antimony remain unchanged when they are touched by the solution; but, by spontaneous evaporation in

* *Comptes Rendus.*

the air, the black antimonial mark is replaced by an orange-red mark of ioduret of antimony. The ioduret remains unchanged by a gentle heat from 86° to 104°, and the air only produces a small alteration in its color, even after several days' exposure.

The solution of ioduretted hydriodic acid acts in the same manner as the alcoholic solution of iodine, but more energetically on spots of arsenic and antimony; on this account we prefer its action to that of the first liquid for establishing the nature of the spots.

We have also found that the solution of the ioduretted iodide of potassium instantly destroys arsenical spots, while it does not, immediately, attack marks of antimony.

All the effects noticed in the first paragraphs demonstrate the new employment of iodine as a test, and add one more characteristic to those we already possess, respecting arsenical and antimonial marks. We think the plan we have adopted may be of service in many cases; its application is so simple and easy, that it can be always successfully put in practice by those who are under the necessity of operating on very small spots.

ON SEVERAL NEW COMBINATIONS OF NAPHTHALINE.*

BY M. LAURENT.

SULPHONAPHTHALIC ACID.

CHEMISTS do not agree as to the composition of this acid. M. Regnault represents it by $(C^{20}H^{16} + 2SO^3)$ while, according to M. Berzelius, the composition of this acid ought to be $(C^{20}H^{16} + 2O^5 + H^2O)$; fresh analyses have conducted M. Laurent to the formula of M. Regnault, in my notation, $C^{10}H^8SO^3$; it is also the only one that agrees with its reactions.

In addition to the preceding acid, there is formed, under certain circumstances, another compound body, to which M. Berzelius has given the name of hyposulphonaphthic acid, and which, according to him, contains $(C^{20}H^{20} + S^2O^5 + H^2O.)$ This formula, incompatible with its action, and with my equivalents, must be incorrect, I have corrected it in my book by substituting a formula which has the same amount of carbon as naphthaline, and represents an acid with a double base.

The experiments of M. Laurent confirm my anticipations; the salt of lead of this second acid, which M. Laurent distinguishes from the first by the name thionaphthic acid, contains $C^{10}(H^6Pb^2)S^2O^6 + 2HO$. The water of this salt is only disengaged at a temperature above 391°.

This is another confirmation of my law on the saturation of compound salts.

M. Laurent also makes us acquainted with several derivatives of the sulphonaphthalic acid by fire, in which chlorine and bromine supply the place of the hydrogen.

By acting on trichlorated naphthaline $[C^{10}(H^5Cl^3)]$, by means of sulphuric acid, we obain trichlorated-sulphonaphthalic acid. The unpurified solution, neutralised by means of caustic potassa, produces an abundant crystallised deposit, the composition of which is represented by

$$C^{10}(H^4KCl^3)SO^3.$$

The trichlorated acid possesses very remarkable properties. It is extremely soluble in water and in alcohol, and it forms a crystalline mass by evaporation. It separates the strongest acids even from their combination with alkalies. When we pour it into diluted solutions of sulphate of potash or soda, chloride of barium or calcium, precipitates of trichlorated sulphonaphthalates of potassium, sodium, barium, or calcium are formed.

The salts of potassium, sodium, copper, and a few other metals, form no precipitate while hot, but if allowed to cool the liquid assumes the appearance of a translucid jelly, composed of extremely long and fine needles. The precipitate from copper exactly resembles the mouldiness which is developed in solutions of tartar.

Quadrichlorated-sulphonaphthalic acid is prepared, like the preceding, by employing quadrichlorated naphthaline. The salt of potassium is perhaps the least soluble in cold water of all the combinations of this metal. It is, therefore, easily prepared by adding caustic potassa to an unpurified solution of quadrichlorated naphthaline. Its formula is

$$C^{10}(H^3Cl^4K)SO^3.$$

Sexchlorated naphthaline does not combine with sulphuric acid.

M. Laurent has also prepared *bromated sulphonaphthalic acid* by acting on bromated naphthaline by sulphuric acid, and neutralising it with potash. The salt of potassium, soluble with difficulty, contains

$$C^{10}(H^6BrKS)SO^3.$$

Bibromated-sulphonaphthalic acid is obtained in the same manner by means of bibromated naphthaline; the salt of potassium contains

$$C^{10}(H^5Br^2K)SO^3.$$

COMBINATIONS OF CHLORINE AND BROMINE.

M. Laurent's paper contains a description of new combinations of chlorine and bro-

* *Journal de Pharmacie.*

OLATILE ACIDS OF CHEESE.*

JENKO AND LASKOWSKI.

of Limbourg cheese, of
re cut into small pieces,
and submitted to distillation
bic, the water that passed
for several days, to prevent
e vessel becoming red hot.
rather clouded ammoniacal
ined; which was supersa-
phuric acid, diluted, and
The product was afterwards
aryta water, and the salt
ted until it crystallised.
again extracted the acid,
d it into a salt of silver.
oved that this volatile acid
valerianic acid $C^5 H^{10} O^2$.
fied the residuum by means
posed the soap with sul-
d it with water, and again
his manner they obtained a
was saturated with baryta
o crystallisation; it yielded
veral salts of baryta, which
y taking advantage of their
of solubility in water: the
en, mixed with seven parts
ated to the boiling point;
baryta $C^6 (H^{11} Ba) O^2$ was
nd afterwards deposited in
ngrattes, while the butyrate
olution; this last they con-
lt of silver $C^4 (H^7 Ag) O^2$,
to analysis.
ryta, that were not dissolved
s of boiling water, consisted
^{19} Ba) O^2, and of caprylate
^{15} Ba) O^2; they succeeded
ng these by means of their
of solubility.
, the cheese contained the
acids:

Butyric acid.
Valerianic acid.
Caproic acid.
Caprylic acid.
Capric acid.

found in it in the greatest
presence of this body had,
eady proved by M. Balard,
heese. All these acids are,
olve, homologous bodies; the
of Messrs. Iljenko and Laskowski
w particulars respecting the
s of the cheese.
boiling alcohol, they ex-
crystallised margarine, fusi-

* *Journal de Pharmacie.*

bleat 27°, and they separated the margaric acid, the analysis of which confirmed that of the margarine. The unpurified margarine was mixed with a certain quantity of a liquid glycerine. In addition to this there was unchanged casein, soluble in boiling water, and insoluble in alcohol. As to mineral substances, there were found lime, a small quantity of magnesia, soda, potash, traces of iron, phosphoric acid, chlorine, and sulphuric acid.

ANALYSIS OF THE TOURMALINES FOUND IN RUSSIA*.

BY M. HERMANN.

M. HERMANN undertook the analysis of a great number of species of the minerals found in Russia. The work now before us treats particularly of the tourmalines, the composition of which is still doubtful, on account of the considerable difference observed in the nature and proportions of the substances of which these minerals are composed. Thus from 1 to 9 per cent. of boric acid has been met with. M. Hermann discovered carbonic acid, and, to complete the uncertainty, iron has often been met, in different states. If we add to this that the formulæ of the silicum and boric acid are themselves the subject of controversy, we may understand the difficulties that are met in establishing correctly the formulæ of minerals resembling the tourmalines into which such varying elements enter.

M. Hermann has entered into a long train of reasoning, by which he endeavours to prove that the silica and the boric acid ought to be represented by the same formula; there are certainly numerous analogies in favor of this resemblance, but we know not how to affirm anything positive on this point. We might with as much reason assign to silica the same formula as to alumina, for in this case, also, analogies are not wanting; but is it quite necessary that a body should have precisely the same formula to enable it to replace another? Have not the protoxide and peroxide of iron different formulæ? And are they not both capable of taking the place of the elements of water in the acids?

Mineralogists find no difficulty in establishing long dualistic formulæ for minerals, which sometimes do not even pretend to a regular form. When they separate some half dozen oxides from a mineral, they easily demonstrate to you, that you have to do with a quadruple, sextuple or decuple salt, composed of 10 atoms of a quadrisilicate of a certain base, + 3 atoms of an octosilicate of a certain other base, with 7 atoms of such a salt, 40 times basic, &c.

This, however, is the case with the greater number of mineralogical formulæ.

When we consider the difficulties we frequently meet with in our laboratories, in purifying by crystallization certain salts, in other respects well defined, and very simply constituted; when we consider the large number of salts which are capable of crystallising together, in the same form, and which are modified in a thousand ways by fortuitous circumstances; by the introduction of foreign bodies, &c., we cannot attach the least value to these dualistic formulæ, by means of which they pretend to represent the compositions of natural silicates.

We must first begin by studying the most simple compound bodies, and assuring ourselves, with certainty, of the base of the silicate, and this is a study which has to be recommenced in the case of most of the salts of chemistry.

* *Journal de Pharmacie.*

ON THE SALTS OF LITHIUM.*

BY M. RAMMELSBERG.

WITH the exception of the arithmetical method, we are unacquainted, up to the present time, with more than one method of calculating the quantity of lithium when it is met with along with soda, as almost always is the case: it was by precipitation, in the form of phosphate of soda or lithium. M. Rammelsberg, therefore, undertook the study of the salts of lithium, for the purpose of discovering a new method of calculating that alkali.

Oxalate of Lithium.—He obtained the neutral salt by neutralising the carbonate by means of oxalic acid, and concentrating it by evaporation. The salt is deposited under the form of a crystalline crust; it dissolves in 13 parts of water at 60°, and is not changed by exposure to the air. Heated to 392°, it loses 4·36 per cent. of water; at a higher temperature, it melts and is decomposed. M. Rammelsberg ascertained the quantity of carbonate of lithium the salt leaves by calcination, and he deduced from this the formula

$$2\,(Li^2O, C^2O^3) + H^2O;$$

that is to say, according to my notation,

$$C^2\,Li^2\,O^4 + Aq.$$

According to this, the quantity of water adopted by the author cannot be correct, besides, it was not ascertained in a direct manner.

The acid salt (binoxalate) was prepared

* *Journal de Pharmacie.*

by evaporating the alcoholic salt along with its own weight of oxalic acid; he obtained it in colourless large tables; it is unchanged by exposure to the air, and soluble in 14·6 parts of water at 50°; it loses its water of crystallisation at 392°, and, at the same time, is partially decomposed. The crystallised salt contains

$$C^2 (H, Li) O^4 + HO.$$

Carbonate of Lithium.—It is known that this salt dissolves better in water charged with carbonic acid than in pure water; it still, however, this solution does not the less dissolve neutral salt.

Hyposulphate of Lithium.—By decomposing sulphate of lithium by means of hyposulphate of baryta, we obtain a salt which, being evaporated over sulphuric acid, assumes an irregular crystalline appearance, and very soluble in water, and attracts moisture from the atmosphere; it is quite insoluble in alcohol, and loses a great part of its water of crystallisation in the sand-bath. One determination of the quantity of lithium appears to lead to the formula

$$Li^2 O, S^2 O^5 + 2 H^2 O;$$

according to my notation,

$$S Li O^3 + Aq.$$

Acetate of Lithium.—Obtained by dissolving the carbonate in acetic acid, and evaporating it in the sand-bath. A determination of the quantity of lithium led to the formula

$$C^2 (H^3, Li) O^2 + HO.$$

Formiate of Lithium.—Obtained by decomposing the sulphate of lithium by means of formiate of baryta; it presents itself in the form of small needles, which become moist in the air. Between 302° and 248° the crystals lose all their water and become opaque. A determination of the lithium leads to the formula

$$C^2 (H, Li) O^3 + HO.$$

Iodate of Lithium.—This salt, previously described by the author, is deposited under the form of a crystalline crust, soluble in 2 parts of water, but insoluble in alcohol. By calcination it disengages iodine and oxygen, leaving a mixture of iodide of lithium and anhydrous iodic anhydride.

Periodate of Lithium.—If we saturate periodic acid with carbonate of lithium, we obtain by evaporation small crystals, rather soluble in water, which are decomposed by concentrated alcohol.

Ioduret of Lithium.—It is only obtained in needles by remaining for a long time in sulphuric acid; its crystals are generally colored yellow by free iodine, and rapidly deliquesce. A determination of the lithium agrees with the formula

$$Li\ C\ I + 3HO.$$

Bromate of Lithium.—This salt, already described by M. Rammelsberg, is deliquescent, crystallises in needles, and effloresces by remaining over sulphuric acid.

Nitrate of Lithium.—The solution evaporated in the sand-bath yields a crystalline powder. The salt is extremely deliquescent, easily soluble in alcohol, and contains no water of crystallisation. According to the determination of the lithium it must contain,

$$N^2 O^5, Li^2 O,$$

that is to say, according to my notation,

$$N Li O^3.$$

Chloride of Lithium.—$Li\ Cl + HO$. If we dissolve chloride of lithium in concentrated alcohol, and leave the liquid over sulphuric acid, it produces irregular crystals containing water of crystallisation, as in the formula mentioned formula.

The separation of Lithium and Soda.—M. Rammelsberg endeavoured to separate the chloride of sodium from that of lithium, by means of almost pure alcohol, but he satisfied himself the separation could not be perfectly effected in that manner.

A mixture of alcohol and ether seemed to him well adapted to the purpose. If we act on anhydrous chloride of lithium by means of common ether, we obtain two strata of liquids which do not mix with each other: the upper, which is the lightest, contains only a small quantity of the salt of lithium, while the lowest stratum is a concentrated solution of chloride of lithium, in the water the other contained, the greatest portion of the salt of lithium remains in a insensible state. But, if we act upon the chloride of lithium even when melted, with a mixture of alcohol and anhydrous ether, this salt is completely dissolved, while nearly all traces of chloride of sodium is retained by the solution. M. Rammelsberg recommends this method for the analysis of minerals in which lithium is accompanied by sodium.

Phosphate of Sodium and Lithium.—This salt, without contradiction, is one of the most interesting of the salts of lithium, is distinguished by its difficult solubility; and may enable us to discover the metal M. Berzelius considered it as

$$P^2 O^5, 2 Li^2 O + P^2 O^5, 2 Na^2 O,$$

but it is shown by the numerous experiments of M. Rammelsberg, that this formula is not correct (neither does it agree with my equivalents), and that the salt is not, in all cases, even of the same composition, but the sum of the equivalents of these metals is always the same when compared with phosphorus and oxygen. According to M. Rammelsberg

this salt is evidently a common trimetallic phosphate, in which the sodium and lithium enter in variable proportions, but in such a manner as always to form

$$P\,(Na^x Li^y)^2 O^4.$$

It forms a yellow precipitate with nitrate of silver, and is not converted into a pyrophosphate by calcination.

ON THE SEDIMENTS OF URINE.*

BY M. HEINTZ.

This author has discussed, in a long essay, the nature of the deposits that are formed in urine, as it cools, whether immediately or at the end of several hours. Sometimes these deposits are crystalline, they are then chiefly composed of free uric acid. Sometimes they are amorphous, and form compound substances, on which physiologists do not agree, from not having analysed them. Sediments of this last description have been examined by M. Heintz with great care; according to him they are composed of urates of ammonia, soda and lime, in variable proportions; sometimes also we find urate of potash in them, and urate of magnesia. This essay also contains several experiments, which, according to M. Heintz, confirm the ingenious views of M. Liebig respecting the solubility of uric acid in urine.

ON A NEW CYANIC ETHER.†

BY MESSRS. WÖHLER AND LIEBIG.

When we saturate alcohol or ether with the vapours of cyanic acid, there is produced, in addition to the body known as cyanuric ether, and which is deposited in crystals, another compound substance, which remains in solution in the liquid portion. This new substance crystallises in large leaves or transparent tables; it is extremely soluble in water, alcohol, and ether; easily fused, and very volatile.

Messrs. Wöhler and Liebig promise shortly to describe its preparation and properties; they have given it the following formula:—

$$Cy\,O, As\,O, 2\,Aq = C^8 H^7 O^2 N;$$

that is to say, that it contains equal equivalents of cyanic acid and alcohol. It is curious to observe, that in the formation of this ether there is no elimination of water.

Spirit of wood yields a similar compound.

* *Journal de Pharmacie.*
† *Ibid.*

ON THE ATOMIC WEIGHT OF URANIUM.*

BY M. RAMMELSBERG.

Chemists do not agree as to the exact number that represents the atomic weight of uranium. M. Peligot adopts the number 750; M. Wertheim, 746·36; M. Ebelmen, 742·875; M. Rammelsberg also made several experiments, the results of which varied from 690 to 736.

The latter chemist has recently again taken up the subject, employing different methods.—(*Annal. de Poggend.*, lxvi.)

A series of experiments were made in the following manner: he acted on a certain weight of protoxide of uranium, by means of a mixture of nitric and sulphuric acids, and determined the weight of the sulphate of uranium produced. This method cannot be correct, on account of the difficulty of obtaining the sulphate perfectly dry without the loss of the acid. The numbers, therefore, of M. Rammelsberg varied from 861·92 to 740·515.

He obtained results still less in accordance with each other, by dissolving protoxide of uranium in nitric acid, mixed with a determinate weight of magnesia, and converting the product into uranate of magnesium, by calcination. Two experiments gave 753·7 and 662·9.

By repeating the experiments of M. Wertheim, which were made with the double acetates of urania and soda, or urania and baryta, M. Rammelsberg obtained numbers, varying between 743·5 and 635·17.

These results, we see, have made no progress in solving the question; they only prove that the methods employed by the author were imperfect.

CALCULATION OF THE PROPORTIONS OF MAGNESIA AND PHOSPHORIC ACID.†

BY M. FRESENIUS.

The erroneous observations we meet with in treatises on chemistry, on the solubility of ammonio-magnesian phosphate, have been the cause of an incorrect appreciation of the quantities of magnesia when this salt is employed; they have equally prevented the use of the same salt in calculating the phosphoric acid.

M. Fresenius, well known for his experiments and his excellent treatise on analysis,

* *Journal de Pharmacie.*
† *Ibid.*

based on the following re-

Berzelius.	Graham.	Clark.
17·67 }	37·1	37·48
20·33 }		
62·00	62·9	62·52

his side, arrived at the

$$\left.\begin{matrix} 2\,Na^2\,O \\ H^2\,O \end{matrix}\right\} + 26\,HO;$$

with

H) O^4 + 13 HO.

the analysis, soda, 16·71 ;
18·80 : water, 64·25.
found 19·87 phosphoric
7 water. These results,
with those of Messrs.
and Berzelius.
a few years back, the quan-
t by phosphate of soda by
following results are re-
gister :—1 oz. neutral phos-
ride crystallised and pressed
between sheets of filtering
water by calcination, that
ent
gress, therefore, with that of
the other chemists.
hosphate of crystallised soda
lost 0·409 water = 40·8 p.c.
0·408 " = 40·6
0·407 " = 40·7
had obtained 400 for 100 of

TS IN PHYSIOLOGICAL RY WITH RESPECT INVERTEBRATED ANI-

M. SCHMIDT.

will read with interest the
periments which M. Schmidt
based on the chemical nature of
that constitute the bodies of
animals. The author has
llowing conclusions from his

animals are characterised
substance, *chitine*, which
rt of their external armour,
cheæ, and probably also the
ntestinal canal. This sub-
esembles woody fibre, is not
r animals, nor in plants; it
ments of protein in addition
h, or those of ammonia in
e of sugar.

Journal de Pharmacie.

2. *Cellulose*, which forms the basis of the tissue of vegetables; not belonging to plants alone, it appears, on the contrary, distributed, to a great extent, among the inferior animals; it certainly enters into the composition of the mantle of the ascidia and frustulia.

3. The parts that compose the smooth or radiated muscles of invertebrated animals, cockchafers, crawfish, &c., are similarly composed.

4. The presence of phosphate of lime is most intimately connected with the formation of cells, and it is probably on a soluble and definite combination of this salt with albumen that the principal part in their formation devolves.

ON THE ATOMIC THEORY AND ELECTRIC CONDUCTION.

The following observations of G. P. T. Hill, Esq., of Tiley, appeared in the *Lancet* of the 3rd instant. They were elicited by some remarks of Dr. Faraday in the same journal; in which, assuming the truth of the atomic theory, he would represent the space between the ultimate atoms as the true medium of electric conduction.

I. Water is a conductor of electricity, but if a compound salt, or a portion of sulphuric acid, &c., be added to it, its conducting power is materially improved, though at the same time its density is also increased. If space be essential to conduction, we ought to expect a corresponding diminution of this power, but the reverse happening, it is clear that this faculty does not depend on the existence of space between the atoms of a body.

II. A rod of metal is a conductor, a similar rod of glass a non-conductor. But space is in both these substances continuous throughout the mass, therefore in the one case it exhibits properties entirely different from the other. Neither can its conducting or non-conducting power be ascribed, in the one case to its union with a metal, or in the other to its union with glass, for it is inconceivable that there can exist any difference in the space between the atoms of glass and that between those of metal. The conduction by bodies is therefore a peculiar force solely resident in themselves, which force is not possessed by all.

III. Some bodies become conductors when heated. This cannot be attributed to the increase of space between their atoms, but may be easily accounted for by considering the close connexion that subsists between the particles of heat and those of electricity, and the one may thus be said to render a substance susceptible of the other.

IV. Potassium is a conductor. Its oxide is a non-conductor. The latter has also a greater specific gravity than the former. This affords no argument for the necessity of space for conduction, for we may surely ascribe its non-conducting power to the change of properties induced by the union of the metal with oxygen. This view is of course applicable to the compounds of sodium &c. with oxygen.

SEPARATION OF ANTIMONY, TIN, &c.*

BY M. ELSNER.

To separate these two metals in quantitative analysis, M. Levol proposed to act on the heated alloy by means of hydrochloric acid, and to add a concentrated solution of chlorate of potash until the whole alloy is dissolved; to precipitate the two metals by a plate of zinc, and to boil the precipitate for an hour in hydrochloric acid; afterwards to collect the remainder of the antimony on a weighed filter, and precipitate the solution that contains the tin by sulphuretted hydrogen.

It is shown by the experiments of M. Elsner, that the antimony is partially dissolved by being boiled in hydrochloric acid, so that the preceding method will not answer the purpose of correctly producing a separation of the two metals.

SEPARATION OF GOLD FROM OTHER METALS.

M. Elsner, while engaged on this subject, discovered that proto-sulphate of iron could not be employed to produce a perfect separation of the gold in a solution containing other metals, from which we wish to separate it. But zinc completely separates all the gold, nevertheless, as zinc also precipitates other metals, it is necessary, in that case, to have recourse to a process allowing of the separation of the gold from the other metals precipitated at the same time. Thus, for instance, in the case of tin, we may pass chlorine gas through the mixture which converts the tin into a volatile chloride.

Mr. Henry Rose has, however, already drawn the attention of chemists to this last process, in the case of metals whose chlorides become volatile by the action of heat.

* *Journal de Pharmacie.*

ON BEZOARIC AND GLAUCOMELANIC ACIDS.*

BY F. MERKLEIN AND F. WÖHLER.

In a chemical point of view, the concretions known as bezoars may be divided into three kinds;—1st, such as consist of phosphate of lime and ammonio-phosphate of magnesia; 2nd, those consisting of lithofellinic acid; and 3rd, those consisting of a peculiar substance, bezoaric acid.

The latter compound is the subject of our examination. We were long ago occupied in an investigation of it, and had succeeded in procuring it in a pure crystalline state and recognised its properties as an acid, when Lipowitz published some experiments which had led him to the same result; but he did not ascertain its composition.' (*Chem. Gaz.*, vol. ii., p. 121.)

The bezoars containing it, and which constitute the true oriental bezoars, are of a dark, olive-green, sometimes brownish or mottled color, usually of an egg or kidney-shape; the surface is smooth, as if polished; they are brittle, and exhibit internally a laminated, concentric structure, having generally some dull surfaces of stratification of a somewhat different color. The surface of transverse fracture exhibits an indistinctly crystalline splintery texture. All the bezoars we have examined contain within them a foreign substance, which is frequently loose, and has evidently formed a nucleus. In some cases this was composed of the chewed bark of a tree; in one it was a fruit, which Prof. Griesbach determined to be that of a leguminous plant. These bezoars have a faint, agreeable smell, like that of musk or ambergris, which is particularly evident when they are bruised or dissolved in solution of potash. They somewhat resemble the bezoars consisting of lithofellinic acid, but are easily distinguished from them by a fragment of the latter readily fusing, while the bezoaric acid is infusible, and is converted into a cinder, which becomes covered with shining yellow crystals.

We find the following to be the best method of obtaining pure bezoaric acid:—The bezoars, separated from the nucleus, are finely pulverised; the powder is covered with a moderately strong solution of caustic potash in a vessel which can be closed air-tight, and which is completely filled: it is then shaken until it is dissolved. The amount of potash must be regulated, that neither bezoarate of potash be left undissolved, nor too great an excess of potash remain. Heat must not be applied, nor must the solution be set aside too long, nor air admitted, otherwise the substance will be decomposed. The solution is of a deep saffron-yellow color When clear, it is carefully removed by a siphon filled with water, from the sediment, which is usually but small and consists of foreign matters: a copious current of washed carbonic acid is then immediately passed through it, which precipitates nearly the whole of the bezoaric acid in the state of a neutral potash salt. The precipitated salt, which is at first almost white, subsequently becoming pale greenish-gray, is separated by filtration, washed repeatedly with cold water without agitation, and pressed between bibulous paper. The yellowish or greenish-brown filtrate is immediately precipitated by muriatic acid; the precipitated bezoaric acid is brown, but may be purified by a repetition of the above process.

The precipitated potash salt is purified by solution in water which has been boiled, and is at an almost boiling temperature, and by filtration, by which it is separated from a heavy green or yellow powder, which is the anhydrous salt, and is formed in greater abundance in proportion to the length of time and the intensity with which the liquid has been heated with the undissolved portion of the potash salt. On the subsequent addition of warm water, the whole is perfectly, but slowly dissolved. On cooling and subsequent repose, the potash salt subsides in voluminous crystalline masses, which are filtered, washed with water, pressed and dried. The acid is separated by redissolving the salt in hot water, and pouring the solution into dilute muriatic acid, at the same time agitating the vessel, and allowing the muriatic acid to remain in slight excess. The precipitated acid is washed with cold water and dried.

The pure bezoaric acid forms a light pale yellow. When magnified, it is seen to consist of transparent prisms. Its specific gravity at 65° F. is 1·667. It is tasteless. At a higher temperature a portion sublimes, condensing in sulphur-yellow crystals on the cinder which is like indigo, but the mass does not fuse; a portion, however, is decomposed. It is but little soluble in cold water, and insoluble in ether. Alcohol dissolves it slightly, acquiring a pale yellow color: the solution is slightly acid. It dissolves in concentrated sulphuric acid, becoming yellow, but is precipitated unchanged on dilution with water. If the sulphuric solution is exposed to the air, the acid is deposited unaltered, in long, delicate, almost colorless prisms. It is immediately dissolved by caustic potash, assumnig a saffron color.

Crystallised bezoaric acid gives off on an

* *Medical Times.*

average 10·88 per cent. of water by heat. This is equal to two atoms (10·64 per cent). It beginsto escape even at 212°. If heated to 392° and upwards, it subsequently remains anhydrous when exposed to the air; but if the water be expelled by a heat of 248°, it gradualy absorbs the water from the air. When precipitated by water from its sulphuric solution, it also contains the same amount of water, although the yellow color, produced on treatment with the concentrated acid, results from its abstraction.

The acid dried at 392°, was analysed with the employment of oxygen gas: it yielded—

	I.	II.	III.	Calculated according to $C^{14}H^2O^8$.
Carbon..	55·67	56·34	55·65	55·67
Hydrogen	2·16	2·11	2·13	1·98
Oxygen..	42·17	42·55	42·22	42·35

Its atomic weight was found from the potash salt precipitated by carbonic acid, as a silver salt could not be prepared, and the lead salt was not constant in its composition. It yielded—

	I.	II.	Calculated according to $KO + C^{14}H^2O^7$.
Potash..	24·32	24·63	24·93
Carbon..	43·99	44·56	44·44
Hydrogen	1·39	1·27	1·05
Oxygen..	30·30	29·54	29·58

Hence the acid dried at 392° F. contains 1 atom of basic water, which is replaced in the potash salt by an atom of potash. The equivalent of the anhydrous acid is therefore $C^{14}H^2O^7$, or 1776·64, and the crystallized acid is $=(HO + C^{14}H^2O^7) + 2HO$.

From this composition, and the properties we have above detailed, we arrive at the remarkable fact, that this substance, as previously suspected by Th. Taylor, is nothing more than ellagic acid, or the acid which was first procured by Chevreul from galls, and more accurately examined by Braconnot. To remove any doubt, we prepared ellagic acid from galls, and compared its properties with the bezoaric acid, and found them perfectly identical. Pelouze, in his analysis of dried ellagic acid, obtained C=55·31 and H=2·66*, and gave the formula $C^7H^2O^4$, which differs from ours by one atom more of hydrogen. Since we constantly found in our analysis more carbon and less hydrogen than Pelouze, we consider our formula as the correct one.

BEZOARATE OF POTASH.

The preparation of this salt has been described above. When dried, it forms a loose, light, papery mass, appearing under the microscope as an interlacement of transparent prisms, frequently combined into fan-shaped bundles, generally of a pale greenish-gray or greenish-yellow color. It is but little soluble in cold water, considerably more so in hot, forming a greenish solution from which it subsides on cooling, in prisms united into flakes. The amount of water was not ascertained; it parts with it so regularly, that even on boiling in a saturated solution it becomes anhydrous and yellow. On heating to redness, it is decomposed, burning, like tinder, without evolving any odoriferous products, leaving a residue of carbon and carbonate of potash. A second salt is formed by adding a solution of hydrate of potash in alcohol to the acid or neutral salt, and digestion; it speedily decomposes. It forms a dark citron-yellow powder, consisting of microscopic, yellow transparent prisms. It is insoluble in alcohol. It must be preserved from access of air, filtered, washed with alcohol, pressed and dried *in vacuo* over sulphuric acid. It becomes blackish-green, and is converted into the neutral salt and carbonate of potash by exposure to the air. It is readily soluble in water, forming a deep yellow solution, which is easily decomposed. It contains 34·0 per cent. of potash. Hence it appears to consist of $KO + 2C^{14}H^2O^7$, which requires 33·2 per cent. of potash. It is consisted of 2 atoms of potash to 1 of acid, it would require nearly 40 per cent. of potash.

BEZOARATE OF SODA.

The neutral salt is precipitated from a solution of the acid in caustic soda by carbonic acid, in the form of a bright yellow crystalline powder, which appears to be more difficultly soluble than the potash salt. It yielded on analysis 17·3 per cent. of soda. The formula $NaO + C^{14}H^2O^7$ requires 17·99 per cent. On dissolving bezoaric acid in a boiling solution of caustic soda, the deep yellow solution, if preserved from contact with air, deposits, on cooling, a voluminous, beautiful lemon-yellow mass of concentric, delicately-radiated, warty aggregations. It is soluble in pure water, and may be re-crystallised from a boiling solution, although a considerable quantity of it is decomposed. In the solid state it immediately becomes blackish-green on exposure to the air.

BEZOARATE OF AMMONIA.

Caustic ammonia does not dissolve much of the acid, but the latter absorbs some ammonia. On mixing neutral bezoaric acid with muriate of ammonia, the bezoarate of ammonia is thrown down in the form of a bright olive-green precipitate. By exposing the anhydrous acid to a current of dry am-

* G=75·12.

moniacal gas, it absorbs it, heat being evolved, and assumes a bright greenish-yellow color. In one experiment, 0·508 grm. of the ammoniacal salt was obtained from 0·449 grm. of the acid; hence the compound appears to consist of $2N\,H^4\,O + 3C^{14}\,H^2\,O^7$. However, when the readily-dehydrated acid was treated with ammonia, its weight was but little altered, although water was copiously evolved. 0·6170 of the ammoniacal salt was obtained from 0·6195 acid. This appears to be neutral bezoarate of ammonia, $NH^4\,O + C^{14}\,H^2\,O^7$.

BEZOARATE OF BARYTA.

When the acid is treated with barytic water, it immediately assumes a deep lemon-yellow color, without dissolving. The air turns it of a pistachio-nut green color; at the same time it absorbs carbonic acid. The dried salt yielded 45·35 baryta. It is composed therefore of $3Ba\,O + 2C^{14}\,H^2\,O^7$, which according to calculation should contain 44·6 per cent. of baryta. The neutral salt would contain 35 per cent., and the acid salt 51 per cent. of baryta. The *lime-salt*, prepared in the same manner as the barytic salt, has exactly the same properties.

BEZOARATE OF LEAD.

When a solution of bezoaric acid in alcohol is mixed with an alcoholic solution of acetate of lead, a yellow amorphous precipitate is formed, which becomes olive-green on drying. It appears essentially to consist of $2Pb\,O + C^{14}\,HO^7$. It gave 63 per cent. of oxide of lead. The formula requires 61 per cent.

GLAUCOMELANIC ACID.

We wish to designate by this name, from the bluish-black color of its salts, an acid which is formed by the action of the air on the basic alkaline bezoarates.

If bezoaric acid be dissolved in a tolerably strong solution of caustic potash, and the deep yellow solution exposed to the air, it immediately assumes a deep reddish-yellow, frequently almost blood-red color, which in a short time becomes paler, the surface of the solution becoming at the same time covered with delicate black crystals, which gradually increase, enlarge, and fall to the bottom; their quantity however is always very small. This is the glaucomelanate of potash. If the solution be exposed to the air too long, bezoarate of potash also separates from the action of the carbonic acid. The solution is decanted, the black crystalline powder is collected on a filter, and washed at first with a weak solution of potash to remove the bezoarate, and then with cold water.

Glaucomelanate of potash forms a black, shining, crystalline powder, tinged with blue; When magnified 200 times, it appears to consist of thin broad prisms, which are transparent and of a blackish-blue color. It is but little soluble in cold water, considerably more so in hot; but in the latter case it is completely decomposed, so that on cooling, the black salt is not again deposited, but bezoarate of potash as a grayish-green crystalline powder. The black salt is dissolved by hot concentrated solution of potash, forming a deep verdigris-colored solution, which soon becomes deep yellow by exposure to the air. It is insoluble in alcohol. Heated in a tube, the black salt gives off water and then carbonises, without evolving any empyreumatic products. It leaves a mixture of carbon and carbonate of potash. By warming the salt with muriatic acid, pure bezoaric acid is separated. Nitrous acid vapour colors the black salt of a beautiful purplish-red, a reaction which bezoaric acid also exhibits.

Glaucomelanate of potash contains water of crystallisation, three-fourths of which are removed *in vacuô*. The whole is evolved at 212°, without the salt being the least altered in appearance. In two experiments the water amounted to 16·96 and 16·72 per cent.

The salt, dried at 392°, when burned in the same manner as the bezoarate of potash, gave—

	I.	II.	Calculated according to $KO + C^{12}H^2O^6$.
Potash	26·88	28·62	27·88
Carbon	41·72	40·96	42·54
Hydrogen	1·29	0·98	1·18
Oxygen	30·16	29·38	28·53

Thus the water in the salt amounted to 4 atoms, or 17·53 per cent. In both analyses the residuary carbonate of potash contained some unburnt carbon, which was calculated for. The potash was estimated by chloride of platinum. The difference in the numbers is explicable from the fact that the salt begins to part with water even at the ordinary temperature. An analogous black salt may be obtained with soda, but it is procured with much greater difficulty.

The authors suggest that the conversion of gallic into bezoaric acid may probably occur when a solution of an alkaline gallate mixed with excess of alkali is exposed to the action of the air, by which the gallic acid is so rapidly decomposed with the well-known changes of color. At a certain period of the action of the air, the solutions may contain bezoaric acid; its formations may have hitherto escaped observation, because it is so speedily changed, which has been before

proved; on the other hand, it must be remarked, that as soon as a concentrated solution of bezoaric acid in potash comes into contact with the air, it exhibits the same alteration of color to a blood-red as a solution of gallic acid in potash.

Considering the relations of bezoaric to gallic acid, it appears highly probable that the animals in which these kinds of bezoars occur, feed upon plants containing tannic acid; this tannic acid is converted by digestion into bezoaric acid, but is not subsequently acted upon by the digestive process, and forms the bezoars.

ON NITRO-BICHLORATED PHENIC ACID.*

BY MESSRS. A. LAURENT AND DELBOS.

This compound is obtained by acting on distilled coal-oil, first by chlorine, and afterwards by nitric acid.

It is yellow, tolerably soluble in boiling alcohol, and it crystalises in very beautiful prisms, which belong to the same system as the bromo-binitrated phenic acid; the inclination of the sides of the prism with respect to the base is the same in both acids, but the angles of the sides are very different. Its composition is represented by

$$C^{24}\,H^{6}\,Cl^{4}\,N^{2}\,O^{6}.$$

How is this acid formed? What substance has given birth to it?

These questions are not difficult of solution, by following the indications one of us has given.

This acid is yellow, it is decomposed, with light, when heated in a close vessel, it has also been obtained under the influence of nitric acid; it, therefore, contains hyponitric acid. $N^2\,O^4$, the acid then becomes

$$C^{24}\,H^{6}\,Cl^{4}\,X\,O^{2}.$$

Now let us replace X by H^2, and Cl^4 by H^4, and we shall have the following formula:—

$$C^{24}\,H^{12} + O^{2},$$

which is that of phenic acid; it is this last body, therefore, which has given birth to that we are describing.

SALT OF POTASH.

It crystallises in very glittering plates, which give, by reflection, two very different colors; under one aspect they are of a beautiful crimson color, under the other, a pure yellow; the formula of this salt is

$$C^{24}\,H^{4}\,K\,Cl^{4}\,X\,O^{2}.$$

SALT OF AMMONIA.

It crystallises in beautiful orange-red needles, and it contains

$$C^{24}\,H^{6}\,Cl^{4}\,X\,O^{2} + H^{6}\,N^{2}.$$

The other salts have a perfect resemblance to nitrophénésates, picrates, and bromo-binitrates. As these compounds confirm also the law of nitrogenated combinations.

The dualistic chemists have given us rational formulæ, which contain either chlorine or hyponitric acid; we wish to ascertain how they represent the acids of this series that contain chlorine and hyponitric acid at the same time. We also wish to ascertain in what manner these chemists, who do not admit of any predisposition in the arrangement of these atoms, could account for the resemblance that exists between all these acids. For our part, without pretending to understand the arrangement of the atoms of these compound bodies, we simply say, that if by the formula of Gerhardt's equiv.

Phenic acid is	$C^6\,H^5$	+ O, that of
Chlorated phenic acid would be	$C^6\,(H^5\,Cl)$	+ O
Bichlorated phenic acid	$C^6\,(H^4\,Cl^2)$	+ O
Trichlorated phenic acid	$C^6\,(H^3\,Cl^3)$	+ O
Tribromated phenic acid	$C^6\,(H^3\,Br^3)$	+ O
Quintichlorated phenic acid	$C^6\,(H\,Cl^5)$	+ O
Binitrated phenic acid	$C^6\,(H^4\,X^2)$	+ O
Trinitrated phenic acid	$C^6\,(H^3\,X^3)$	+ O
Nitrobichlorated phenic acid	$C^6\,(H^3\,X\,Cl^2)$	+ O
Bromobinitrated phenic acid	$C^6\,(H^3\,X^2\,Br)$	+ O

Chemists who admit crude formulæ, give us the following:—

Phenic acid	$C^{24}\,H^{12}\,O^2$
Trinitrated phenic acid	$C^{24}\,H^6\,O^{14}\,N^6$
Nitrobichlorated phenic acid	$C^{24}\,H^6\,O^6\,N^2\,Cl^4$.

We renounce the task of representing the rational formulæ of the dualistic chemists, for we should fail, not to take into the reckoning four hypothetical bodies for each acid, some forty impossible compound bodies, and the inevitable conjunctions.

* *Comptes Rendus*, Dec. 29, 1845.

PREPARATION OF ARTIFICIAL DIAPHANOUS SILICA.*

BY M. EBELMEN.

When we expose one of the two silicic ethers M. Ebelmen has made us acquainted with, to the prolonged action of a moist atmosphere, the liquid becomes, in the end, solidified into a transparent mass, if we take the precaution of allowing the air to enter by an opening of very small diameter; the silica thus prepared is perfectly transparent, and its composition is precisely the same as that of a hydrate $Si^2 O^2 + H^2 O = Si^2 H^2 O^3$, that is to say, true silicic acid. This substance is hard, scratches glass slightly, and possesses considerable cohesion; its clearness, fracture, and transparence are quite equal to the purest rock-crystal; its specific gravity is 1·77. M. Ebelmen is in hopes he shall be able to render this substance useful in the construction of optical instruments.

By a slight modification of the preceding process, we obtain, instead of a transparent product, an opaque substance, which becomes perfectly transparent when placed in water; in one word, it is a true *hydrophane*. To obtain this result it is necessary that the silicic ether employed should retain a small quantity of chloride of silicium, and this is the case when the alcohol has not been in excess in the preparation of the ether. The product thus obtained has the semi-transparence of opal, and becomes completely transparent in water.

In this manner we may produce, artificially, the hydrophane, the curious properties of which so much engaged the attention of ancient mineralogists.

ESSAY THE FIRST, ON TOBACCO.*

BY M. BARRAL.

The experiments which have been published on tobacco, up to the present time, offer many contradictions, arising from the fact of the experiments of the chemists who have made them not being capable of comparison. They have not, in fact, been made on the same variety of the plant; sometimes green tobacco, at others dried, unmanufactured tobacco; sometimes manufactured tobacco, either in the form of snuff or prepared for smoking, were submitted to experiment without clearly indicating the nature, the state, and the part of the plant submitted to chemical examination. On the other hand, although the first experiments on tobacco were made at a time when the processes of analysis were scarcely known, and when organic chemistry was in its infancy, we still admit without discussion, certain results, which have established their position in science although they are extremely doubtful.

These considerations induced me to resume, from the very beginning, the experiments which had been made on tobacco, up to the present time. In the monograph on tobacco, the first portion of which I have the honor of submitting to the consideration of the Academy, I have successively brought under notice the green or dry plant, and the different descriptions of manufactured tobacco.

In the first memoir, I examine the composition of the dry leaves, and that of the different substances they contain. I give the composition of the ashes, the rind, and leaves of foreign tobacco, from Havannah, Holland, Kentucky, Maryland, and Virginia; of the roots, stalks, rind, leaves and seeds of the French tobaccoes of the Lower Rhine, Ile et Vilaine, Lot, Lot et Garonne, Nord, and Pas de Calais. The result of the experiments described in my essay is, that the amount of ashes contained in all kinds of tobacco is less in the stalks and the rind than in the leaves, and that on the contrary it is still less in the seed. In round numbers the proportion of ashes is 7 per cent. in the roots, 10 in the stalks, 22 in the rind, 23 in the leaves, and only 4 per cent. in the seeds.

The different varieties of tobacco examined, which were raised on soils the nature of which was necessarily extremely different, produced ashes the composition of which was extremely varied. But in the midst of this variation, one constant fact presents itself well worthy of notice. M. Liebig laid down this principle, that in the same plant, according to circumstances, a base can replace its equivalent by means of a different but analogous base, but this principle has not been confirmed, after a series of experiments made upon plants brought from so many different countries. It results from the figures contained in my memoir, that, with the exception of the roots, the quantity of oxygen contained in the bases of the ashes of the stalks, the rind, and the leaves, of every variety of tobacco, is on the average 13 per cent. The roots contain an enormous quantity of silica, at least eight times greater than in any other part of the plant.

It is also extremely worthy of remark that in the twelve varieties of tobacco examined, the quantity of silica is always greater in the leaves than in the rind. As to the lime and potash, we may also make two new obser-

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* *Journal de Pharmacie.*

† *Comptes Rendus*, Dec. 22, 1845.

vations, namely, that the quantity of lime increases as it passes from the roots to the stalks, the rind, and finally to the leaves; while the quantity of potash only diminishes after leaving the stalks, as it passes to the rind and finally to the leaves.

In the same manner as tobacco is the plant that produces the largest quantity of ashes, so, also, is it that, which of all other plants analysed up to the present day, contains the largest quantity of nitrogen. This quantity varies according to the varieties from 5 to 6 per cent in the leaves; the rind containing from 1 to 1·5 per cent. less than the leaves of the same species.

In the seeds we find about 6 per cent. of nitrogen, and also 10 per cent. of a colorless fat oil; on account of the small size of the seed this part of the plant has hitherto escaped the inquiries of chemists: it is so small that 11,105 dry seeds only occupy the space of a cubic millimetre, and weigh no more than 0gr.·51175.

The liquor we obtain by leaving the leaves of the tobacco plant to digest in water, is extremely acid. Vauquelin attributes this acidity to the presence of malic acid. By causing the syrup to crystallise, at which point Vauquelin stopped, either in the vacuum of the air-pump, or in a gentle heat in the open air, I obtained a salt in micaceous laminæ, soluble in water, and producing an insoluble crystallisable salt of lead, salts of ammonia, nicotine, potash, &c.

The nicotic acid has for its atomic formula

$$C^6\ H^2\ O^3 + H^2\ O;$$

and the salt of lead or silver,

$$C^6\ H^2\ O^3 + Pb\ O \text{ or } C^6\ H^2\ O^3 + Ag\ O$$

The great tendency possessed by this acid to form double salts, and all the reactions it produces, allow us to presume that the preceding formula ought to be doubled. It is decomposed by heat and sulphuric acid, into acetic acid and carbonic acid, bodies in which its formula is decomposed into

$$C^6\ H^4\ O^4 = C^2\ O^2 + C^4\ H^4\ O^2.$$

It seems that this acid ought to bear the same relation to metacetonic acid, as oxalic acid bears to acetic acid.

The essence of tobacco, nicotianine, is nitrogenised, it yields nicotine by distillation with potash; its composition is

Carbon	71·52
Hydrogen	8·23
Nitrogen	7·12
Oxygen	13·13

In that portion of experiments which treats of botany, I have been assisted by M. Duchartre, whose experiments on the seeds of the tobacco plant are the subject of a note, which I have added to my memoir.

ON A SERIES OF DOUBLE SALTS OF THE PROTOXIDE OF MERCURY.*

BY THOMAS BROOKS.

NITRATE OF THE PROTOXIDE AND PEROXIDE OF MERCURY.

The protonitrate of mercury, as we well know, acquires a yellow color on being preserved for some time, owing to a partial higher oxidation. The peroxide formed combines with the undecomposed protoxide to form a basic double salt. According to Wittstock, this latter salt can be obtained very pure and of constant composition by boiling 1 part mercury with 1½ part pure nitric acid, of spec. grav. 1·2, in a spacious flask until the mercury is entirely dissolved. During this operation the yellow salt commences to be deposited. Now if the temperature of of the liquid be kept for some time near the boiling-point, a considerable quantity of the yellow salt is deposited, and subsequently white basic protonitrate of mercury. The salt thus prepared is anhydrous, and loses at 212° only a little interstitial water; at the same time it becomes of a darker yellow at this temperature, but on cooling reassumes its previous colour. The salt may gradually be exposed to a temperature of 392° without being considerably changed; it merely assumes a transitory orange color; at 392°, however, it disengages nitrous acid, and leaves, at a somewhat higher temperature, very pure peroxide of mercury.

It may be readily proved that the protoxide of mercury in the yellow salt is combined with peroxide in the basic state; for if the salt be triturated with chloride of sodium, it gradually becomes brown-red, and if water be then added, peroxide of mercury is detected in the filtered solution, by sulphuretted hydrogen. If the insoluble residue be treated with dilute muriatic acid, this dissolves the peroxide and leaves protochloride of mercury. On boiling the yellow salt for some length of time with water, protonitrate of mercury remains in solution, while peroxide and metallic mercury are separated. If, on the contrary, the salt is boiled for some length of time, the air being excluded, it does not become black. The solution then, only contains pernitrate of mercury with a trace of protonitrate. The insoluble residue likewise contains both oxides.

If the salt be treated with a solution of caustic potash, the liquid filtered from the oxide contains pure nitrate of potash, which may be obtained in distinct crystals. When cold sulphuric acid is poured over the salt in the dry pulverized state, nitric acid vapors are

* *Poggendorf's Annal.*, lxvi, p. 63.

sparingly evolved after some time. In the course of 24 hours the whole has changed into a white saline mass, which on the application of heat gives off vapors of nitric acid: consequently the acid contained in the salt is nitric acid, and no longer oxide of nitrogen. To analyse the salt, it was treated in the cold with dilute hydrochloric acid, and the liquid filtered from the formed protochloride of mercury, acted upon with sulphuretted hydrogen. To render the determination as accurate as possible, the salt should not be employed in too large a quantity, and the application of heat carefully avoided. The attempt to convert the perchloride of mercury into protochloride by formiate of soda gave no accurate result. To determine the nitric acid, carbonate of baryta was digested with the salt and some water, and the baryta precipitated from the filtered solution by sulphuric acid. The analyses yielded the following results:—

Protoxide of mercury.....	45·10	43·89	42·55	42·69	2	43·57
Peroxide of Mercury.....	43·66	44·49	46·41	44·49	4	45·22
Nitric acid	12·54	11·14	10·98	10·59	2	11·21

The composition of the salt may therefore be best expressed by the formula $2Hg^2O, NO^5 + 4HgO + NO^5$.

SULPHATE OF THE PROTOXIDE AND PEROXIDE OF MERCURY.

When the preceding double salt is gently heated with an excess of a solution of sulphate of soda, a sulphate of mercury is formed corresponding to the nitrate. It is of a similar colour, anhydrous, insoluble in cold water, and is not decomposed by boiling water. Hydrochloric acid decomposes it even in the cold, separating protochloride of mercury; the sulphuric acid is removed from the filtered liquid by chloride of barium; the peroxide of mercury by sulphuretted hydrogen. The analysis made in this way yielded—

Protoxide of mercury	44·45	44·21	44·50	2	44·88
Peroxide of Mercury	46·84	46·84	46·26	4	46·58
Sulphuric acid	8·56	8·60	..	2	8·54

The formula for the compound would be $2Hg^2O, SO^3 + 4HgO, SO^3$.

The basic persulphate of mercury, which is combined in the salt with basic protosulphate, has a different composition from that obtained by treating persulphate of mercury with water (the so-called *turbethum minerale*); this, as is well known, is $3HgO + SO^3$. Rose has shown that the neutral persulphate is not, as is generally believed, separated, on its decomposition by water, into an acid and a basic salt, but that the water here acts the part of base, and replaces the peroxide of mercury from its weak basic properties.

The author decomposed neutral persulphate of mercury by continued digestion with cold water and evaporation of the filtered solution at a gentle heat. A white crystalline salt separated, which was purified from the mother-ley by frequent pressure between blotting-paper. In the examination of the salt dried at 212°, it was found to contain 28·04 per cent. sulphuric acid.

A second portion of the persulphate of mercury was decomposed with boiling water, and digested with warm water for 24 hours. After evaporation of the filtered solution, a considerable quantity of a beautiful yellow turbeth was deposited from the hot solution, being apparently soluble in hot water; however, it possessed entirely the composition of turbeth. The liquid filtered from the turbeth was evaporated further, until on cooling a considerable quantity of the white salt had separated in shining scales, which were again freed from the mother-ley by pressure. This salt consisted of 27·82 per cent. SO^3 and 71·37 per cent. HgO, corresponding therefore to the neutral persulphate. From these experiments, it follows that in the decomposition of the persulphate of mercury by water, no acid sulphate, but a neutral salt and free sulphuric acid are obtained. But might not the entire persulphate of mercury be converted, by a sufficiently large quantity of water, into basic salt and free sulphuric acid, so that no neutral salt remained in the liquid, as this has been distinctly proved in the case of nitrate of bismuth?

PHOSPHATE OF PROTOXIDE AND PEROXIDE OF MERCURY.

This salt is formed by the decomposition of the pulverized nitrate of the proto and peroxide of mercury with a concentrated solution of ordinary phosphate of soda. The salt changes its color, and becomes of a darker yellow. It is heated faintly, but not to boiling, and washed for a very considerable length of time with cold water. The phosphate of the proto and peroxide of mercury obtained become blackish on the surface on

exposure to the air, especially in the moist state; it contains neither nitric acid nor soda. The protoxide of mercury may be determined in the salt by hydrochloric acid, the peroxide by treating the filtered solution with sulphuretted hydrogen. The phosphoric acid may be estimated by igniting the salt with oxide of lead, from the increasing weight of the latter. The salt contains water, which cannot be volatilised at 212°, but only at a temperature at which the salt is completely decomposed. The analyses yielded—

					Mean.
Protoxide of mercury	44·56	44·92	44·67	..	44·72
Peroxide of mercury	45·15	44·65	44·73	..	44·84
Phosphoric acid	4·56	4·72	4·27	4·67	4·55
Water	..	..	..	..	5·89

Although the quantities of phophoric acid in the above analyses agree very well, this was not the case in samples prepared at different times. With respect to the relative amount of peroxide of mercury, this compound contains less, from a small quantity being dissolved by the phosphate and nitrate of soda of the mother-ley.

When the nitrate of the proto and peroxide of mercury is treated with a solution of pyrophosphate of soda, it is rapidly decomposed in the cold, and acquires a darker color than the other double salts. The filtered liquid contains much protoxide of mercury, but very little peroxide. The salt obtained is readily decomposed by washing with boiling water, metallic mercury being eliminated.

OXALATE OF THE PROTO AND PEROXIDE OF MERCURY.

The nitrate was treated with neutral oxalate of potash; no decomposition appeared to result in the cold, but only when warmed to 86°—120°. The filtered liquid contained neither protoxide nor peroxide. The salt is free from nitric acid, reddish-brown, and is very readily decomposed, even below 212°, into a grayish-brown mass, which contains much metallic mercury. The double salt undergoes this decomposition much sooner than either the protoxalate or peroxalate separately.

PYROPHORUS FROM TARTAR-EMETIC.*

A VERY dangerous pyrophorus may be produced by igniting tartar-emetic in a closed crucible. In some experiments to prepare pure antimony in Prof. Wackenroder's laboratory, several ounces of tartar-emetic were submitted to a slight calcination. On emptying the carbonaceous residue, which was still somewhat warm, from the crucible into a dish, it took fire in a few minutes, probably by being breathed upon, and was then suddenly projected about the laboratory, forming a shower of fire.

* *Archiv der Pharm.*, xliv., p. 187.

ON THE ACTION OF PRUSSIC ACID, THE CYANIDES, ALKALINE CHLORIDES, BROMIDES AND IODIDES; ON MERCURIAL COMPOUNDS, ESPECIALLY ON THE PROTOCHLORIDE OF MERCURY.*

BY DR. E. RIEGEL.

SEVERAL cases have recently occured in which the internal use of the protochloride of mercury with dilute prussic acid has been accompanied by highly injurious consequences. This arises from the prussic acid decomposing the protochloride of mercury, and forming percyanide of mercury and hydrochloric acid, with separation of metallic mercury. Scheele, and subsequently Soubeiran and Regimbeau, observed the decomposition of calomel by bitter almond water, and that on mixing prussic acid with protochloride of mercury, percyanide of mercury was constantly found. By mixing 100 grains of calomel with 25 ounces of cherry-laurel water, Béranger obtained 90 grains of undecomposed calomel, 5 grains of cyanide of mercury, and 5 grains of metallic mercury. Béranger has, however, not stated what became of the hydrochloric acid which was formed in his experiments. According to Mialhe, on pouring an excess of prussic acid upon protochloride of mercury, there is formed, first, percyanide of mercury, muriatic acid, and metallic mercury; as soon, however, as this reaction is over, muriatic acid and percyanide of mercury act so upon each other that perchloride of mercury and hydrocyanic acid result; however, this decomposition is only partial. A little ammonia and formic acid occur as accessory products. Ether readily extracts the prussic acid and corrosive sublimate, and leaves undissolved the cyanide of mercury.

The behaviour of prussic acid towards the protoiodide and protobromide of mercury, as well as to the protosalts of mercury, is analogous to its action on calomel. Corrosive sublimate is also decomposed by prussic

* *Journ. für. Prakt. Pharm.*, x., p. 8, and *Lancet.*

acid, a certain amount of cyanide of mercury is formed, and a corresponding quantity of hydrochloric acid. In some recent experiments with cherry-laurel water, Béranger observed, indeed, the formation of cyanide of mercury, but was unable to detect the formation of perchloride of mercury and hydrochloric acid, as iodide of potassium produced no precipitate in the water digested with calomel. This phenomenon is explained by the fact that the chlorine which is set free by the decomposition of the chloride, combines, entirely or nearly so, with the benzoyle, forming chloride of benzoyle. On evaporation of cherry-laurel water which has been digested with calomel, there is obtained, besides crystallised cyanide of mercury, a yellow, oily fluid, soluble in water, but not in ether, with a strong odour of oil of bitter almonds and a sharp, burning taste; it becomes hard on drying, and resembles gum-arabic. Mixed with pure lime, and exposed to a red heat in a glass tube, decomposition occurs, dense suffocating vapors are given off, resembling those of benzoic acid, and the chlorine combines with the lime; the reaction of the cherry-laurel water, therefore, should be distinguished from that of pure prussic acid.

When 6 ounces of cherry-laurel water of the Prussian Pharmacopœia are poured over 1 ounce of calomel, immediate decomposition ensues, the formation of metallic mercury being at once perceptible. If the mixture is digested at the ordinary temperature for eight days, and the liquid filtered from the gray sediment, the solution exhibits no essential change with reference to its original odour; it possesses a metallic taste and faintly reddens blue litmus-paper. Hydrosulphuret of ammonia produces in it a black precipitate; iodide of potassium, a yellowish-white one, which soon becomes dirty red, but finally assumes a beautiful scarlet red; nitrate of silver, a white precipitate insoluble in nitric acid; lime water and caustic potash produce no change. When the liquid is evaporated, it loses its original odour and acquires one similar to that of balsam of Peru. A crystalline powder separates, and at the bottom of the vessel a yellowish oily substance.

When a mixture of calomel and cherry-laurel water in the above proportions is digested for five or six hours between 176° and 194°, being frequently agitated, the reaction appears to be far more energetic, the protochloride of mercury becomes black, and the filtered liquid possesses an intense metallic taste, strongly reddens blue litmus-paper, and no longer blackens calomel. It yields, with hydrosulphuret of ammonia, an abundant black precipitate, with iodide of potassium a white one, which soon becomes yellowish, and finally scarlet, and with nitrate of silver a precipitate insoluble in nitric acid. A slip of copper immersed in it becomes immediately coated with a film of mercury. When the liquid is diluted, it is rendered turbid, and finally exhibits some yellow oily globules. On cooling, two distinct layers are perceptible, an upper aqueous one, and an under oily one, of the color of cinnamon oil. By evaporating the former, a residue is obtained, consisting of percyanide of mercury, perchloride of mercury, chloride of ammonium and benzoic acid, as well as some muriatic acid.

The oily substance is of a yellow color, bears a great resemblance to oil of cinnamon, and has the odour of the hydruret of benzoyle; it boils at about 250°, when a colorless fluid of somewhat less specific gravity passes over, which solidifies on cooling, and is a compound of hydruret of benzoyle and perchloride of mercury. The unrectified fluid undergoes no apparent change at low temperatures; it dissolves in every proportion in ether, in 30 parts of water and 10 parts of alcohol; it was found impossible to deprive this body of the perchloride of mercury by treatment with water or chloride of sodium; but the whole of the corrosive sublimate may be removed by repeated mixing with a solution of chloride of ammonium, when the substance appears to become only somewhat specifically lighter. Hydrocyanic acid could not be detected in it.

This oily body is not formed when a solution of percyanide or perchloride of mercury in cherry-laurel water is evaporated; it is, however, obtained when a corresponding quantity of hydrochloric acid is added to solution of the percyanide. The presence of hydrochloric acid appears to cause the formation of this body, which is independent of the action of the cherry-laurel water upon calomel, for it is only produced upon evaporation, and at a certain concentration of the liquid. When, instead of evaporating this, it is saturated with chloride of sodium and treated with ether, the latter leaves, on evaporation, oil of bitter almonds, which contains some hydrochloric acid.

On treating calomel with dilute prussic acid, phenomena analogous to the above occurred, with the exception that no formation of the oily body resulted even on evaporation. Bromide and iodide of mercury behave precisely like calomel. The action of the alkaline chlorides upon the protochloride of mercury constitutes an

exactly similar phenomenon. According to Mialhe, calomel in the presence of chloride of ammonium, potassium, or of sodium and pure water, is converted, partially, into perchloride of mercury with separation of some pure metal; the protiodide of mercury likewise passes under the same circumstances into periodide. According to the experiments of Cattanel di Monia, calomel in contact with chloride of ammonium, or common salt, at 104°-118° undergoes no change; but corrosive sublimate is formed at 212°. Larroque arrived at the same results in his experiments. The latter thinks that the protochloride of mercury cannot be converted into the perchloride without the separation of metallic mercury. Mialhe attributes the formation of perchloride solely to its affinities for the alkaline protochlorides. The formation of the perchloride is less when the air is excluded than when it is omitted. The alkaline protochlorides form, in the presence of calomel and atmospheric air, three times as much corrosive sublimate as without air, since at the ordinary temperature calomel is capable of absorbing a certain quantity of air, as was shown by Guibourt; at a higher temperature the absorption is greater, and it is likewise hastened by the presence of the alkaline chlorides. Each equivalent of peroxide of mercury, formed by this absorption of oxygen, yields, by double decomposition with the alkaline protochlorides, one equivalent perchloride and one equivalent alkaline oxide. It is remarkable that the perchloride is not decomposed by the alkali. Mialhe explains this from the great affinity between the perchloride and the alkaline chlorides; at least magnesia precipitates corrosive sublimate alone, but not in combination with an alkaline protochloride; whence it follows that the alkaline solution of protochloride decomposes calomel into corrosive sublimate with excess of air, without the liberation of metallic mercury. According to this the chlorides of the alkalies convert the calomel in the cold partially into perchloride without separation of metallic mercury; but on the application of heat, corrosive sublimate is formed and metallic mercury set free.

Since the perchloride of mercury occurs in the above mixture only in combination with alkaline oxide, or as basic perchloride, ether, according to Mialhe, does not remove anything from it. Larroque, on the contrary, asserts, that when a mixture of one part calomel, one of an alkaline protochloride, and forty-two parts water, are kept boiling for some time, the perchloride can be detected in the filtered liquid by iodide of potassium, protochloride of tin, and sulphuretted hydrogen; when chloride of ammonium is employed, the application of heat is not even necessary to give rise to the production of perchloride, which may be extracted by ether.

Selmi found that calomel in contact with animal albumen was partially converted into corrosive sublimate, not only when the reaction was alkaline, but even in the presence of some free acetic acid. If four grains of chloride of sodium are dissolved in three drachms of albumen, and shaken for fifteen minutes with three grains of calomel, metallic mercury is formed; while ten grains of chloride of sodium, dissolved in two drachms of water, give no reaction with three grains of calomel. Chloride of ammonium acts more powerfully under the same circumstances than chloride of sodium, about as $\frac{1}{2} : \frac{1}{4}$. According to Grimelli, the albumen itself, from the sulphur it contains, acts on the calomel, on which account the albumen of eggs which have been sat on exhibits a stronger reaction than that of fresh eggs.

When one part of calomel is mixed with two parts of an alkaline chloride and ten parts water at the ordinary temperature, no perceptible reaction occurs. After digestion for several days, the protochloride of mercury becomes somewhat gray, and most so when chloride of ammonium was employed. The quantity of perchloride of mercury remaining on evaporation is, however, very inconsiderable. On heating a mixture of an alkaline chloride with calomel and water, the sediment becomes of a dark-gray colour, arising from the separation of metallic mercury, and the presence of perchloride of mercury may very readily be detected in the filtered liquid. On evaporating the liquid, and treating the residue with ether, the perchloride formed is extracted. When calomel is shaken for ten or fifteen minutes with the chloride of an alkali and albumen, the separation of metallic mercury and formation of corrosive sublimate is immediately perceptible.

The alkaline bromides and iodides have likewise a decomposing action on calomel; it is entirely decomposed by an excess of alkaline protiodide, especially on the application of heat; the mixture becomes gray, yellowish-red, melts and becomes brownish-black; metallic mercury and periodide of mercury sublime in consequence of the decomposition of the protiodide in the presence of alkaline protiodides. The residue is whitish, entirely soluble in water, and consists of alkaline protochloride and alkaline protiodide. The alkaline and other soluble protiodides, as those of ammonium, magnesium, iron, and zinc, decompose calo-

mel, which at the moment of contact assumes a grayish-green color, that on trituration of the mass becomes dark green. Under the influence of light, the mixture acquires a yellowish, and finally red color; at the same time globules of metallic mercury are observed, protiodide of mercury and alkaline protochloride being formed. On treating the protiodide or protobromide of mercury with a chloride of the alkalies in the presence of water, no apparent change of the protobromide or protiodide appeared to occur at the ordinary temperature; but if the mixture be exposed to the temperature of 212°, some periodide or perbromide is dissolved in the liquid.

OBSERVATIONS ON SOME POINTS IN THE CHEMISTRY OF THE URINE.*

BY J. W. GRIFFITH, M.D.

1. It has usually been considered that the amorphous deposit ordinarily occurring in the urine is the lithate of ammonia, mixed with variable portions of urate of soda and lime, and sometimes magnesia. The cause of the deposit assuming the amorphous form has always been, and still remains, in our opinion, a difficulty, and we think receives no explanation from the mere fact of the lithate of ammonia being mixed with lithate of soda and lime. If so, why does it ever assume the crystalline form when mixed with the soda?—and the spheres of lithate not uncommonly occurring in urine are decided crystals, and possess the optical characters of such. We think it a question whether the crystalline salt obtained by M. Heintz, and containing from 12·73 to 14·79 per cent. of soda, is the same as the amorphous urinary compound, the inorganic constituents of which are exceedingly variable in quantity, and amount (2·28—8·02 per cent).

2. We differ from those who, with Liebig, consider that soda has anything to do with the solubility of uric acid in urine. The fact of urate of ammonia being deposited from the urine, either by exposure to cold or the air-pump is sufficient to show that it exists therein in combination with ammonia and not soda; and how can this occur from a mixture of phosphate of soda, uric acid, and hippuric acid (Liebig's artificial urine)? In our opinion, uric acid most probably exists in the blood in combination with soda; and although under ordinary circumstances, as in the case with urea, we cannot detect it, (being probably excreted as rapidly as it is formed,) still, in certain morbid conditions, where it is apparently formed in excess, it is secreted from the blood in this form, as we see in and around the joints of gouty patients: here the compound is not exposed to the salts capable of decomposing it, as in the urine. At the moment of its secretion from the kidney, it is probably decomposed by muriate of ammonia. If a deficiency of this is formed, a quantity of the urate of soda will escape decomposition, and appear in the urine. Whether tribasic phosphate pre-exists in the urine is very problematical, as we know of no process by which either the soda or its carbonate, or such compounds as yield this on incineration, can be removed from the alkaline phosphate prior to the combustion of the ash; and supposing with Löwig that the phosphate is the ordinary one, the atom of water it contains could be replaced by an atom of soda, as long since shown by Graham.

3. Regarding the presence of ammonia in urine, the chloride of platinum test applied previously to evaporation (and, of course, it cannot be applied after) is entirely fallacious. Admitting that the lithic acid exists as bilithate of ammonia, 1000 grains of urine contain, on an average, one grain of lithic acid; this would combine with 0·1892 grains of ammonia, which would form 2·341 grains of ammonio-chloride of platinum. Since one part of ammonio-chloride of platinum dissolves in 150 parts of cold water, 1000 grains of urine (admitting urine to be as good a solvent as water) might contain more than twice as much ammonia, and yet the chloride of platinum would yield no precipitate.

* *Lancet*, Jan. 10th, 1846.

EXAMINATION OF BEES-WAX.*

BY CH. GERHARDT.

According to Lewy, the constituents of bees-wax differ from those of the ordinary fats only by a higher or lower degree of oxidation. According to him, wax may be converted into stearic acid by the fixation of oxygen. However, the author does not agree with the formula which Lewy has advanced for wax, but prefers the formula $C^{19} H^{19} O^2$†, which agrees far better with all the analyses hitherto made of it, and by which it becomes analogous to margaric, æthalic, myristic, butyric, and acetic acids, &c. The analyses of stearic acid upon which this formula is based are the following:—

* *Ann. de Chim. et de Phys.*, and *Chemical Gazette.*

† C = 75, H = 12·5.

	Chevreul.	Redtenbacher.				
Carbon....	76·4	76·5	75·4	75·8	75·6	75·8
Hydrogen..	12·4	13·0	12·8	13·0	12·6	12·8

	Stenhouse.			Erdmann.			Lewy.	
Carbon....	75·8	75·6	75·9	76·3	74·7	76·5	76·73	77·03
Hydrogen..	12·7	12·8	12·8	12·8	12,8	12;8	12·86	12·81

The above formula requires 76·5 per cent. carbon and 12·8 hydrogen.

DRY DISTILLATION OF WAX.

The author observed, in the destructive distillation of wax, the same phenomena in general as already described by Ettling; a white granular solid mass condenses in the recipient, and floats in a fluid oil, and during the whole of the operation a mixture of carbonic acid and olefiant gas is disengaged. The solidified body consists of a fatty acid, a solid and several liquid hydrocarbons. The first portions of the distillate may be almost entirely saponified, and only a few particles of the solid hydrocarbon float in the liquid. By decomposition of this soap with muriatic acid, a perfectly white fatty acid was obtained, which after being purified by recrystallisation from a mixture of alcohol and ether, fused at 140°, and solidified on cooling to a radiate mass. Analysis proved it to be margaric acid, viz.—

Carbon	75·1	17 =	1275·0	75·6
Hydrogen ..	12·8	17 =	212·5	12;6
Oxygen	12·1	2 =	200·0	11;8

The solid hydrocarbon obtained in the distillation is, according to Ettling, paraffine, which consists, according to some recent experiments of Lewy, of $C^{20} H^{21}$, or $C^{24} H^{25}$, which latter formula is most probable, when considered with the boiling-point of paraffine. If the oily carburetted hydrogen obtained in the above distillation is treated with a solution of caustic potash, much margaric acid is removed, the previously acid products become neutral, distil readily on rectification, and leave a solid residue of paraffine. The oil, rectified once, is generally yellow or greenish; it is, however, easily obtained colorless by distilling it with potassium after desiccation over chloride of calcium. The author regards the oil as a mixture of several isomeric hydrocarbons, for its boiling-point gradually rises from 322° to 396°; Ettling's product however boiled at 266°. One of these oils, whose boiling point rose rapidly to 414°, when it remained constant, yielded on analysis—

Carbon	85·4	1 =	75·0	85·7
Hydrogen	14·6	1 =	12·5	14·3

Two other samples, which boiled at different temperatures, gave the same results. The density of the vapour was found to be 5·52, which corresponds to the formula, $C^{12}H^{12}$. Chlorine does not remove any hydrogen from this oil, which circumstance confirms its identity with olefiant gas.

In the dry distillation of stearine, the same mixture of hydrocarbons is obtained. The boiling-point of the oil, distilled over potassium, and rectified, commenced at 374°, and gradually rose to 464°. The analysis yielded 80·0 per cent. carbon and 14·6 per cent. hydrogen. The formula for wax, advanced by the author, corresponds entirely with its products of decomposition, which may be expressed as follows:—

Wax. Margaric acid.
$$4C^{19} H^{19} O = C^{17} H^{17} O^2 +$$

Carb. acid. Paraffine.
$$CO^2 + C^{24} H^{25} + C^{24} H^{24}.$$

PRODUCTS RESULTING FROM THE ACTION OF NITRIC ACID.

When wax was boiled with nitric acid, the same phenomena occurred as in the action of this acid on stearic acid or other fatty bodies. Much nitrous vapour was disengaged, and the residue, after two hours' boiling, dissolved entirely in a hot solution of carbonate of soda. On cooling, the whole solidified, forming a greasy soap of a yellow colour. After twenty-four hours' boiling, the wax had completely dissolved in the nitric acid; an oily body floated on the solution, which had the odour of rancid butter, and dissolved completely in potash. It reacted acid, and possessed all the properties of *azoleic* or *œnanthylic acid* of Laurent, which is formed in the oxidation of stearic acid and other fatty bodies.

When wax was boiled for several days with twice its weight of nitric acid until all the oily substances had disappeared, pimelic acid first crystallised; this yielded on analysis—

Carbon.....	52·0	7 =	521·0	52·5
Hydrogen.....	7·9	6 =	75·0	7·5
Oxygen	40·2	4 =	400·0	40·0

The mother-ley yielded a tolerable quantity of hemispherical warts of adipic acid, which however were without doubt mixed with some lipic acid. The latter acid was also obtained in acicular crystals on evapo-

rating the fluid; the last mother-ley yielded no further crops of crystals, and was rendered turbid by the addition of water, from the separation of oily azoleic acid.

When, finally, wax was boiled with nitric acid until no more red vapours were disengaged, beautiful crystals of succinic acid were formed. It is, evident therefore, that the products of the decomposition of wax are identical with those obtained from the fats. The author observed, that when pimelic acid was fused with hydrate of potash, at first much water, and subsequently, at a somewhat elevated temperature, hydrogen gas were liberated. The residue becomes somewhat yellowish, and yields, on distillation with sulphuric acid, a volatile acid having the odour of valerianic acid. The collected liquid was saturated with ammonia, and precipitated with nitrate of silver; the precipitate became quickly black by exposure to the light. Another portion of the residue, on being carefully saturated with nitric acid and treated with chloride of calcium, gave a precipitate of oxalate of lime. Supposing the volatile acid to be valerianic acid, the reaction would be as follows:—$C^7 H^6 O^4 + 2H_2O = C^5 H^5 O^2 + C^2 O^3 + H O + 2H_2$. Suberic, adipic and azoleic acids behaved in the same manner. The volatile product of the fatty acids had the odour of rancid butter, and gave a white precipitate with salts of silver, which became black on boiling. It probably likewise contained formic acid.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

REPORT ON AN ESSAY ON "THE CULTURE OF THE ARRACACHA."*

BY M. BOUSSINGAULT.

THE Academy has charged us with the task of reporting on an essay of M. Goudot, entitled "The culture of the Arracacha, and the possibility of introducing it into Europe."

The arracacha belongs to the family of the umbelliferæ, and its resemblance to smallage (apium) caused the Spaniards to call it apio; it very probably comes from the Andes of New Granada, where it is extensively cultivated.

From the temperate plains of Cundinamarca, the arracacha has advanced beyond the equator, and establishing itself in the Andes of Popayan and Cos Pastos; at the same time as the potato, leaving the cold regions of Chili, was propagated to the south and north, following the Incas in Peru, before it penetrated into New Granada.

It is curious to observe in the history of the aliments of mankind, in South America, maize cultivated by the smallest populations, while to this grain, in some sort normal, are added plants important, as far as food is concerned, among nations who have arrived at a more advanced stage of civilisation. For instance, the arracacha among the Muyschas, the potato propagated by the Incas, the cacao, in use among the Mexicans. Maize and the potato form at the present day the staple food of the greatest number of Europeans; cacao is almost indispensable in Spain; the arracacha, alone, has not as yet entered the list of our cultivated plants.

This plant, however, offers us all the advantages we recognise in the potato, and it is developed under the same circumstances of soil and climate. In fact, in the Andes, we see the finest plantations established in localities whose average temperature is from 57° to 71°.

The author of the essay we have examined, lived for twenty years in New Granada, where, at his own expense, he devoted his time to the study of natural history, and many of our associates have had an opportunity of appreciating the richness of his collections: being about to return to France, M. Goudot wishes to bestow upon his country a useful plant, and it is for that purpose he has devoted himself to the study of the culture of the arracacha, and thought of the means of facilitating its arrival in Europe. M. Goudot has not confined himself to gathering information and visiting plantations; he has done better. Taking advantage of his residence at Ibague, at the foot of the mountain chain of Quindiu, M. Goudot cultivated the plant, and what he says of its habits and its growth he has observed himself, and he gives the results of his practical experience.

They propagate the arracacha by cutting off the neck of the root in such a manner that the fleshy part, which is detached, becomes the base for a tuft of petioles. This circular base is divided into many segments, and these cuttings are afterwards placed in moist ground, at a very little depth. The space between the plants is about 6 centimetres.

* *Comptes Rendus*,

Under favorable circumstances, the cuttings begin to shoot in a few days, their growth is rapid, and at the end of a few weeks, the ground is completely covered. Before this time, at which period of its growth the plant has become strong enough to oppose the increase of weeds, the ground is hoed, generally twice. The crop is gathered in before the plant comes into flower. According to M. Goudot, they know when the time of maturity has arrived by the size of the stem and by a slight bloom that appears on the outer leaves; after this time the plant has a tendency to run up. At this period of its growth, the root, which is the special object of the cultivation, is a fleshy and somewhat irregular mass: numerous spindle-shaped ramifications spring from the lower part, covered with fibres, which as an aliment are the most delicate parts of the arracacha. A root out of good ground weighs from 2 to 3 killogrammes. At Ibsgue, M. Goudot, has raised 41,000 killogrammes from a hectare.

According to an analysis made by our reporter, this root is probably less nourishing than the potato, for in equal weights, and with the same proportions of starch and albumen, the arracacha contains a greater quantity of water.

When cultivated by M. Goudot, the root remained six months in the ground before it was harvested, and some plants that were left in the ground blossomed at the end of the ninth month, and were in seed about the tenth.

The medium temperature of Ibague is about 70°; it is evident, therefore, that if a temperature of 71° were necessary for the space of six months for bringing the arracacha to maturity, it would succeed with difficulty in the temperate parts of Europe, because, taking for example the climate of Paris, the six months during which vegetation is most active, have a temperature that does not quite reach 60°. But the arracacha, like the beet-root, soon arrives at a tolerable degree of maturity. An early harvest has already yielded a crop of a good description, the only inconvenience is that it diminishes the quantity. Thus, we are informed, by the particulars furnished by Doctor Vargas, that at the Caraccas they take up the arracacha three or four months after it has been planted, and that this space of time is sufficient to give the root every desirable quality; and as the Caraccas has exactly the same average temperature as Ibague, it follows, that if in the course of one hundred and twenty-two days, at a temperature of 70°, the arracacha can be harvested, we have every reason to believe that the culture of this root may be completed in the one hundred and fifty-one days comprised between the first of May and the end of September, the medium temperature of Paris being 60°. What we should have to fear, perhaps, for the success of this culture, would be, the heat of the summer, for we know that the arracacha, cultivated in a warm and rainy country, soon runs to stem, at the expense of the growth of the root.

The mode of propagation described by M. Goudot would not be practicable in Europe, where winter would necessarily intervene between the planting and the harvest, and we should have great difficulty in preserving a large quantity of productive cuttings from one season to the other. We should be obliged, therefore, to preserve through the winter, either in a cellar or in trenches, a certain number of the roots, from which, at the moment of plantation, the segments from the neck which furnish the petioles, might be removed. In this manner, beet-root and carrots, intended for seed, are preserved; but experiments must decide whether this mode of preservation is fitted for the root of the arracacha.

We can readily perceive that an alimentary plant as important as the arracacha, must for a long time have attracted the attention of travellers who have visited the Andes, and consequently many attempts have been made to introduce it into European cultivation. About the year 1822, Baron Schack forwarded some plants to England, and two of them blossomed in the Botanical Garden at Liverpool; these plants succeeded but imperfectly. After this attempt, however, a few weak specimens were met with in the market, at a very high price, and the root which feeds whole populations in New Granada, was debased, in Europe, to play the insignificant part of a rare plant. In 1829, M. de Candolle received a number of roots from Dr. Vargas, but the plants only produced imperfect seeds; this attempt, however, had still this fortunate result, it enabled the illustrious botanist of Geneva to give a complete botanical description of the plant. Some years afterwards, our associate, M. Vilmorin, obtained a quantity of the roots from Bogota, which, unfortunately, were completely spoiled when they arrived. A short time afterwards very expensive experiments to cultivate it, which were completely unsuccessful, were resorted to by Soulange-Bodin. Finally, M. Vilmorin, jun., a member of the Royal Society of Agriculture, procured several roots, which he forwarded to M. Hardy, the Director of Orchards, at Algiers; he could not have placed them in better hands.

M. Goudot, who became acquainted with these unsuccessful attempts, thought they ought to be attributed to a want of knowledge of the mode of propagation he has described, and which consists, as we have seen, in planting the cuttings from which the petioles spring, which crown the root, and that it was quite wrong to have endeavoured to produce seed, an attempt very difficult to realise, and frequently unsuccessful even in the native country of the arracacha.

When M. Goudot left the plains of Bogota, he brought with him several boxes full of the cuttings in full vegetation. In consequence of unavoidable delays, these young plants had, for two months, to endure the excessive heat of the valley of Magdalena; still, by great care, these plants arrived in good condition at Santa Marta, but by that time it was too late to proceed to Europe. M. Goudot planted these roots in the *Naciendа*, at Minca, situated in *Sierra Nevada*, of *Merida*, possessing, on account of its elevation, a temperature of 68°.

For the purpose of introducing into Europe a plant of the Cordelliras, you could not select a more suitable intermediate station, because, in addition to the advantage of its proximity to the sea, the *Sierra Nevada* has a great variety of climates, and if at any time, your commission should induce the Minister of Agriculture to consider it useful to make a last attempt to introduce the arracacha into France, they will, without doubt, recognise the importance of the station pointed out by M. Goudot.

In fine, M. Goudot's essay contains interesting details, and true facts, on the history, organisation, culture and propagation of the arracacha.

ON THE TESTING OF SODA.*

BY F. F. DALE.

A VARIETY of methods have been proposed for testing the sodas of commerce; the author prefers the following:—Some clear pieces of the soda to be examined are selected free from dust, they are pulverized, well-mixed, and 10 portions, each of 200 grs., weighed off, and preserved in stoppered phials; that each of the five experiments may be repeated.

1. Two of these portions are dissolved in distilled water and neutralised with dilute sulphuric acid. Great care should be taken to attain the point of neutralisation as accurately as possible, which is best recognised by tincture of litmus, whereby the two liquids are equally coloured. The liquid appears red before complete neutralisation, owing to the carbonic acid dissolved in it; but if it be warmed to remove the carbonic acid, it again becomes blue, and more dilute sulphuric acid must be added to it until no further effervescence results, and the liquid on warming retains a violet color. This operation is most easily performed in an evaporating dish. By this neutralisation with sulphuric acid, not only the carbonate of soda, but also the sulphuret of sodium and hyposulphite of soda, which occur as impurities, are converted into sulphate of soda, while the chloride of sodium is only decomposed with an excess of sulphuric acid. The liberated hyposulphurous acid is immediately decomposed into sulphurous acid, which escapes as a gas, and into sulphur, which at first renders the liquid turbid, but then separates in flakes, and may be removed by filtration. The liquid is now precipitated with chloride of barium, filtered, and the precipitate washed, ignited and weighed. Its weight corresponds to the total weight of the carbonate, sulphate and hyposulphite, as well as of the sulphuret of sodium contained in the soda.

2. Two portions of 200 grms. of soda are mixed, each separately, with 400 grms. of pure saltpetre, and melted in a crucible, it being advisable to dry the saline mass previously in order to avoid the effervescence and loss. The fusion may very well be made in a porcelain crucible over an Argand lamp. By this operation both the hyposulphite and the sulphuret of sodium are oxidized into sulphate of soda; and when the fused mass is dissolved in distilled water and an excess of muriatic acid, and then precipitated with chloride of barium, we obtain the sulphate of baryta, both from the sulphate of soda present as such, as well as that formed from the hyposulphite and sulphuret. On subtracting the weight of this sulphate of baryta from that previously found, we obtain the quantity corresponding to the carbonate of soda.

3. The same quantities of soda are treated in the bottles, with alcohol of 0·876 spec. grav., frequently agitated, and left for some time in contact; the alcohol, which contains the sulphuret of sodium in solution (when this is present in any quantity, it is colored yellow by it), is now poured off, evaporated to dryness, the residue mixed with nitre and fused in a crucible. In this case we obtain the sulphate of soda corresponding to the quantity of sulphuret, and its amount may be determined by precipitation with chloride of barium.

4. The sodas from which the sulphuret has been removed by alcohol are dissolved

* *Chemical Gazette.*

in water and an excess of muriatic acid, and the usually turbid liquid resulting from decomposed hyposulphite of soda, heated until the sulphur has separated. The filtered liquid, on precipitation with chloride of barium, yields the quantity of sulphate of baryta corresponding to the sulphate of soda contained in the soda. By subtracting it, as well as that obtained in experiment 3, from the weight of sulphate of baryta found in experiment 2, we obtain the amount corresponding to the hyposulphite of soda.

5. Two fresh portions of soda are dissolved in distilled water supersaturated with nitric acid, and warmed until the turbid liquid has become clear, upon which it is filtered and precipitated with nitrate of silver. The chloride of silver, collected on a filter, must be well edulcorated to remove any sulphate of silver, until what passes through is no longer rendered turbid by muriatic acid.

If the soda should likewise contain lime and iron, they may be separated and calculated according to the usual methods. The author found, on accurate examination, that the method described answers its object perfectly.

OBSERVATIONS ON THE PRESERVATION OF WOOD, BURIED IN THE EARTH.*

BY M. BOUCHERIE.

SEVERAL years have passed since the communication I addressed to the Academy of Science; but, nevertheless, my experience on the preservation of wood have not been for an instant interrupted. The pieces I now submit to the judgment of the Academy are evidence of my perseverance, and confirm, by extending them, my first results. I wished to give to my experiments the certainty and precision the numerous and important occupations in which wood is employed have a right to exact, and I waited with impatience for a favorable opportunity to prepare at one time a large number of varieties of wood, and to expose them afterwards to those influences that rapidly destroy them.

This opportunity was offered me three years since, when the Minister of the Marine imposed on me the task of preparing wood in the forest of Compiègne. I have laid before the Academy the results I have obtained.

In 1842, in the month of November, I caused 100 pieces of wood of different sorts to be cut (beech, elm, birch, alder, and the sapwood of the oak) of the size and length of the sleepers on a railroad.

Some of these pieces were left in a natural state.

The greater number were completely saturated with preservative liquids.

A dozen of these were impregnated with these liquids for only half their length.

The preparations being completed, all the pieces were buried in a spot of ground enclosed within the walls (the pheasant preserve at Compeigne), in the presence of an agent of the Marine, who was ordered to accompany me, the inspector of the forest, and many of his assistants; a statement was prepared of the time the experiment was made, and the nature of the wood; three copies of this statement were made, one remained in the hands of the inspector of the forest, the second was forwarded to the office of the crown lands, and the third was placed in my hands.

After three years trial, I proceeded, in the present month of November, 1845, to take up the buried wood, in presence of the same parties, accompanied by the mayor of Compeigne, the chief engineer, and the engineer in ordinary of the navigation of the Oise, the captain of engineers, and others; and I established the following results:—

1. The billets of wood in a natural state, of whatever kind they were, are in so forward a state of decomposition that they can be penetrated at each end by a soft body, and divided in the same manner in any part of their surface.

2. The billets, completely prepared, are in a perfect state of preservation, and appear, even as the witnesses assert, to have improved in the earth.

3. The billets prepared through half their length are those which offer the most conclusive results. In fact, the two halves of each billet, although identical in their nature, although placed in the same circumstances, presented the most decided difference between each other; the prepared end was sound, and at least as hard as new wood of the best quality, the other half that was not prepared, gave way before the least touch, and had become the centre of vegetation for a large number of fungi.

To judge of the value and bearing of these results, it will be sufficient to refer to a few facts practically established.

In the construction of railroads for example, they have been only able, up to the present time, to employ billets of heart-of-oak, and that, because every other description, as well as the sapwood of oak, became rotten soon after the wood was placed in

* *Comptes Rendus.*

the earth, as trials made in Belgium and elsewhere have proved. . . . Well, at present, according to my experiments, it is evident that the greater number of the varieties, as well as the sap-wood-of-oak, may compete with heart-of-oak; we may even assert that the woods thus prepared have received a marked improvement, since their having been buried for three years had not in the least injured them, while it had modified, in a manner easily recognisable, the strength and solidity of the oak.

Merely confining ourselves to the preservation of wood under ground, and drawing from the recited facts the most direct consequences, we may easily perceive the advantage the vine dressers and miners must gain by the employment of these methods of preservation; we know, in fact, that every year the renewal of the vine poles, and the replacement of the shores in mines occasion an expense which amounts in France to 10,000,000 of francs annually.

The half prepared billets were impregnated with pyroligneous acid, those completely prepared had received, some of them, sulphate of copper, others pyrolignited chloride of calcium, and a third series, bichloride of sodium and mercury.

The cost of preparation will in no case exceed four francs the *stere*.

Several specimens of the wood buried at the same time in the pheasant's preserve at Compeigne, accompanied this account, some of which were impregnated with the preservative liquids, either through their whole extent, or only in a part of their length, and others had undergone no preparation.

OBSERVATIONS ON M. BOUCHERIE'S EXPERIMENTS ON PRESERVING TIMBER.*

BY M. SMITH.

M. SMITH, in consequence of a recent communication of M. Boucherie, calls attention to the attempts that have been made on various occasions to impregnate timber with conservative substances. With respect to M. Boucherie's process, he proposes to prove, on one hand, that the process is not new, and on the other that its efficacy is not properly proved. "In the experiments at Compeigne," says M. Smith, "the results cannot be conclusive, because the conditions of the experiment were not practical, having prepared the pieces of wood, not with dry timber, which ought to have been employed, but with recently-cut billets, the rapid destruction of which any one might have foreseen."

M. Smith's paper was sent to be examined by the commission charged with the duty of reporting on M. Boucherie's last experiments.

* This paper was presented at the next meeting of the Academy.

NEW PATENT FOR SEPARATING SILVER FROM OTHER METALS.*

BY J. TAYLOR.

THE invention has reference to the separation of silver from ores or metallic combinations containing that metal. The patentee first describes the principal methods now in operation for the extraction of silver from its ores and metallic combinations, which are—

1. The process known under the name of the eliquation process, in which the argentiferous substance, whether ore, regulus or metal, is mixed and melted with lead, or some combination of lead, when the silver is obtained in combination with the lead from its great affinity for that metal.

2. The amalgamation process, in which a chloride of silver is formed by mixing common salt with the ore or regulus in calcination, which chloride of silver is again reduced by means of metallic iron and mercury, the chloride passing to the iron, and the silver forming an amalgam with the mercury.

3. A process for which a patent has recently been obtained, the object of which is, the obtaining silver from various known descriptions of copper regulus, procured by smelting argentiferous copper ores, by concentrating the main portion of the silver into a residuum; this is to be effected by thrice-repeated calcination of the regulus, having for its object the formation of as much sulphate of copper as possible, and lixiviation of the sulphated materials with sulphuric acid and water; after each calcination, the undissolved residuum from each of the first two calcinations is to be melted with some material containing sulphur, so as to form it again into a regulus; the residuum of each lixiviation becomes richer from the sulphate of copper and iron being dissolved out, and from only a small portion of the silver being removed as sulphate. When the contents of the first residuum are 100 parts or more of copper to 1 of silver, it is reduced into a regulus by melting with partially calcined copper ore or iron pyrites, and this regulus is sulphated and lixiviated as before, and the product is a residuum containing less than

* *Chemical Gazette.*

100 parts of copper to 1 of silver; this is subjected to the same process, and the product is a residuum containing less than 50 parts of copper to 1 of silver; this residuum is called the rich sulphate residuum, and is to be calcined and digested in sulphuric acid, nitric acid and water, and the silver precipitated from this solution; the residuum of this operation is to be added to a residuum containing less than 100 parts of copper to 1 of silver, and melted as above described, or the silver is to be obtained from the rich sulphate residuum by melting it with lead or litharge. A portion of the silver is obtained in each calcination in the state of sulphate, and is washed out by sulphuric acid and water with the sulphate of copper; this silver is to be precipitated.

In describing his invention, the patentee divides it into two parts:—1st, the formation of a chloride of silver, and the dissolving such chloride of silver by any of the herein-after-mentioned solvents; 2nd, the converting the whole, or practically the whole, silver contained in an ore or regulus into a sulphate of silver by a process of calcination as here-in-after described, the other metals contained in the ore or material treated being rendered insoluble. The sulphate of silver thus formed he dissolves out by hot water.

He then proceeds to describe the means adopted for the attainment of these objects; and first, as regards the chloride process of extraction. The argentiferous materials, which it in all probability will be desirable to treat, may be divided into two classes—those containing sulphur, and those containing no sulphur.

First, as regards sulphurous material. If the material to be treated is a regulus of copper or iron, it is preferred first to granulate such regulus by allowing it to flow when hot into water; it is then calcined in a similar furnace to those used for calcining copper regulus, for a time varying from 12 to 36 hours, according to the nature of the regulus under treatment and the quantity in the calcining furnace: 24 hours' calcination for about 3 tons of copper is found to be a very suitable time; during this calcination a moderate fire should be kept up, sufficiently low to prevent the regulus caking; the material should be stirred or turned over once in about every 2 hours. The object of this process is to volatilize a portion of the sulphur, by which means nearly the whole inconvenience arising from the caking of the material in the subsequent calcination, is avoided; the regulus so calcined is then ground, and passed through a fine sieve. A sieve of 60 holes to the square inch is well suited to this purpose. In the same manner, sulphurous ore, which it might be inadvisable to melt from its being already sufficiently rich in silver and needing no concentration, would be most advantageously treated by calcining it as above described, previous to grinding it, in order to prevent the formation of lumps in the after process of calcination; having been calcined, it is then ground to a fine powder, and treated in the following manner, which is equally applicable to calcined regulus. The furnace to be employed is a simple reverberatory calcining furnace, of such size as to enable the workmen constantly to rake the ore lying on every part of it. The heat on the introduction of every fresh charge should be moderate, gradually increasing until it arrives at a bright red heat, approaching yellow; the operation usually lasts from 2 to 3 hours, during which time the material operated on must be constantly raked for the purpose of thoroughly oxydizing the copper, iron, and other metals contained in the ore or regulus. A test should now be made of the state of the material operated on; this is done by withdrawing a small portion, and at once, whilst still hot, pouring water on it, and allowing the water to pass through it; should the water appear colorless, or nearly so, the operation of calcination has been carried sufficiently far: but should it be blue or green, the calcination must be persisted in until the green or blue color disappears from the liquor derived from the lixiviation of a small portion withdrawn from the furnace as described, that is, until the whole of the sulphate of copper and iron has been decomposed. When this has been effected, chloride of sodium (common salt), or any other suitable chloride, is to be added in the proportion of from 4 to 5 parts of salt to 100 parts of the substance treated; a less proportion will do, but to ensure the whole silver being converted into a chloride, the above proportions have been found advantageous. The heat of the substance operated on should be reduced previous to the addition of the salt, in order to avoid a too great evaporation and loss of chlorine. On the addition of the salt the material should be well stirred for some time, and a degree of heat maintained sufficient to cause the chlorine or muriatic acid to arise in almost invisible fumes; in which the argentiferous substance should be allowed as it were to soak. A test may now be again made for the purpose of proving whether the calcination has been thoroughly performed; this consists, as before, in withdrawing from the heated furnace a small portion of the substance treated, and pouring over it a hot saturated solution of chloride of sodium (common salt), taking care not to add too much. If this solution is clear and colorless, and becomes, when cold water is added to it, of a whitish color, the calcination has been complete; but

if the solution takes a bluish or greenish color, the calcination must be continued until the bluish or greenish color disappears from the solution, and it remains colorless, as above described (when water is added it assumes a whitish color). The operation may be hastened by strewing over the substance in the furnace another half-pound or pound of common salt for every 100lbs of material in the furnace; and the whole must be constantly stirred, as above described. So great is the affinity of silver for chlorine, that it has been found in many instances sufficient to rake the material which has been calcined out of the furnace, and while hot mix it with salt, when the desired chloride of silver has been produced. Should the material it is desired to de-silverize contain no sulphur, or other substance which it is necessary to volatilize or oxidize by such a calcination or calcinations as above described, common salt, in the proportions before given, namely from 4 to 5 of salt to 100 parts of ore or argentiferous substance, may be at once added; and the argentiferous material placed immediately in the furnace, and treated in precisely the manner above described as that adopted for the formation of a chloride of silver in argentiferous regulus or ore; beginning from the point of a small portion of sulphurous material, such as sulphurous copper ore, iron pyrites or sulphate of copper, has been found to facilitate this operation. A chloride of silver having been thus formed, the argentiferous ore, or substance prepared as above, is to be washed or lixiviated with a hot saturated solution of chloride of sodium (common salt), or any other suitable chloride, alkali or earth, or with a solution of hyposulphite of soda, of hyposulphite of potash, or any other suitable hyposulphite of an alkali or earth which will dissolve the chloride of silver, separating it from the insoluble portions of the material treated. From this solution the silver may be precipitated by any of the known methods; precipitated copper has been found an exceedingly good means of effecting this operation. The heat at which it has been found most advantageous to employ chloride solutions is their boiling-point, or at least 60°R. or 170°F. The temperature of the solution is necessarily effected by the temperature of the substance when subjected to lixiviation. Hyposulphite solutions need not be so hot, as their solvent power is greater.

To ascertain that all the silver has been precipitated, a piece of bright copper, or new copper coin, may be put into the solution in the precipitating vessels. If these maintain their color, the liquor may be drawn off, as the precipitation may then be considered complete; but if they come out silvered, it may be considered that sufficient time has not been given for the complete precipitation of the silver.

If the material treated has been copper regulus, some chloride of copper will of necessity be in the solution, as also if copper has been used for precipitation. The liquor, in this case, from which the silver has been precipitated, may then be passed into vessels containing iron, free from oxide scale, where the copper will be thrown down, together with any silver which may have remained unprecipitated; and the copper thus obtained may be used for precipitation of silver, as above described. It may be desirable to economise, as much as possible, the salt used in this process, in which case the lixiviated residue may be further washed, and the liquor obtained preserved, together with that obtained from the precipitation, and having been brought up to the point of saturation, may be again used for the extraction of further quantities of silver.

The second part of the invention consists in the conversion of the whole, or practically the whole, silver contained in any ore or regulus into the state of sulphate of silver, rendering the other metals contained in the argentiferous substance insoluble. If the material to be treated is a sulphurous ore or regulus, it is to be operated on precisely in the manner already described above, as regards the preparatory calcination of argentiferous ore or regulus, with the ultimate view of forming chloride of silver. This part of the invention may be considered to begin from the point at which the ore or regulus has been finely pulverised, after the calcination of the granulated regulus or ore. The ore or regulus is then placed in a calcining furnace, which must be well-provided with a current of atmospheric air passing over the substance heated: and the charge should be constantly raked throughout the whole of the operation. This operation lasts generally about three hours, and depends entirely on the good management of the furnace and constant attention to the state of the material acted on. At first the heat must not be great; a moderate heat should be continued until the sulphur ceases to rise in thick fumes, and until, by withdrawing a small portion of the material from the furnace, it is ascertained, by smell or otherwise, that the greater portion of the sulphur has been dissipated; after this more heat may be gradually given, until it at length arrives at a full red heat, approaching yellow. This must be done very cautiously, and during the whole operation the following test must be constantly put in practice. A small portion of the material treated is withdrawn from the furnace, and water, free from

chlorine, poured on it whilst hot, or hot water must be used; the liquor thus obtained is then tested by adding a few grains of common salt; when the operation is not complete, the liquor, when first obtained, will be bluish, and when salt is added greenish. The silver, when only a small portion has been formed into a soluble salt by the calcination, will simply cloud the liquor when salt is added. As the operation of calcination advances, the blue and green color will nearly disappear from the liquor obtained from the test; and when salt is added, chloride of silver will be at once thrown down, falling to the bottom of the liquor in thick white flakes; when this appearance is given by the test, the operation of calcination may be considered to be complete, the whole, or practically the whole, of the silver being in a state of sulphate, the copper and iron having been oxidised, and thereby rendered insoluble. The material may then be withdrawn from the furnace, and lixiviated with common boiling water, care being taken that it shall be free from chlorine, or only contain a trace of chlorine.

If the material lixiviated be sufficiently hot, the water need not be boiling. From this solution the silver may be precipitated by any of the known methods; and the completeness of the operation may be tested by adding a few grains of salt to the liquor taken from the precipitating vessels; if the liquor remains clear the precipitation is complete. The residue obtained from large quantities has been found to vary from 3000 to 2000 parts of copper to 1 of silver, and was therefore practically wholly desilverized. Regulus or sulphurous ore may also be at once heated in a calcining furnace, having been first pulverised, without any previous calcination, as above described. In this case very slow heat must be given for the first part of the process, during which time the sulphur contained in the regulus or ore undergoes combustion. After a time this combustion ceases, and the process described, as the invention for the conversion of the sulphuret of silver into sulphate begins, and may be performed precisely in the manner pointed out to be practised on the regulus already previously calcined and afterwards ground. This is not considered an advantageous manner of working, from its being impossible to prevent the formation of lumps, which must be separated from the fine parts before lixiviation, and again ground and calcined; and also from the necessity of passing the calcined material through a sieve, by which the whole benefit of the heat is wasted; also from regulus being much more readily pulverised when granulated and calcined; and from the saving of labor effected by calcining three tons, or a large quantity instead of a small quantity, which must be the case if the process of calcination is performed at once. Should it be desired to treat by the sulphate process an ore which in itself contains no sulphur, and at the same time inadvisable to convert it into a regulus, a small portion of sulphur in any shape, such as sulphurous copper ore or iron pyrites, may be mixed with it, so as to afford sufficient sulphur to combine with the silver; it may then be calcined, as before directed, particular attention being paid to the test. For the purpose of lixiviation, a round tub, fitted with a strainer formed of a disc of wood, pierced with holes, a disc of basket-work, and linen drawn over the whole, answers the purpose well; tow being packed round the sides between the strainer and the tub, the liquor runs off perfectly clear.

ON COCHINEAL.*

BY AUGUST. FABER.

At a meeting of the Pharmaceutical Society, on the 26th of last November, the following paper was read:—

Mr. Faber obtained from a merchant, residing at Oaxaha, whence cochineal is principally obtained, the following information:

1. "Silver cochineal is the impregnated female just before laying eggs: black cochineal is the *female after laying and hatching the eggs.*"

2. "The female just before laying the eggs, spreads out a large quantity of white powder immediately around her, and to a great distance, in a circle; and the Mexican growers are in the habit of blowing this white powder off the plant as much as possible, saying the young do better without it."

This explains something of the origin of the difference of color and shape and *quantities;* the black, if good, is always *shelly,* the real silver is *never* shelly, and of black cochineal, there is never more than one bag in twenty or in thirty, or fifty imported, being in fact only what had been kept for seed.

The reason why the Honduras cochineal (which, in fact, grows in Guatimala), is *invariably* brilliant in color (silver) white the Mexican is *invariably* dull, the latter selling for threepence and fourpence per pound less than the former, Mr. Deane considers to be the habit of the Mexican growers of blowing off the white powder deposited by the females.

* *Medical Times.*

The more extensive cultivators never kill the insect by immersion, but by placing the basket in heated rooms or stoves. The others use hot water, by which the insect is mostly burst open, and the "foxy" color produced. "foxy" is the technical London name for silver cochineal, rather reddish, and very different from the fine transparent red which forms the finest black.

The sirrons in Guatimala are made up to 150lbs. (it is either four or eight arrobes that made 100lbs., therefore a bag is either six or twelve arrobes), a mule *there* not being able to carry more than three hundred pounds over the mountains. In Vera Cruz, the distance from shore is 300 miles, but not being so mountainous, the mules carry 400lbs., the sirrons being made one-third larger than at Guatimala.

In London, every sirron of cochineal on its arrival, is turned out and sifted by the dock companies, filled into English bags, on which the tare to the ounce is marked, the dust of a whole parcel (of 100 to 500 bags) being put together and sold separately from the grain. The custom of sifting exists in no other port than in London.

There still exists as an article of commerce, but only just still exists, the sort called "English dyed black cochineal."

When, in 1826, Mr. Deane established himself in London, this article was extensively shipped to India, Russia, and Austria, and for a number of years his price current had the quotation of "English black cochineal;" and, in fact, being cheaper in many places, they would not have the genuine black. It was Mexican silver grain *dyed*, and prices were about the following:—Genuine black, 6s. 6d.; English dyed, 5s. 6d.; Honduras, silver, 5s. 6d.; Mexican silver, 5s.

Granilla is imported from the same places as the cochineal, namely, Honduras and Mexico, and consists of the very small immature insects. Its value is from two shillings to four shillings per pound, according to quality.

Garblings consist of the broken pieces of the insects, mixed with the dust and extraneous substances that must of course be gathered with the insects in taking them from the plants. As garblings contain generally a good proportion of the broken particles of matured insects, they are frequently preferred to granilla, unless the latter be of unusually good quality. The value of garblings is two shillings to two shillings and sixpence per pound. Each bag of cochineal is sifted here on importation, and it is in this manner that the garblings are obtained, as they are seldom imported so.

The following is a table of the quantities of cochineal exported from and consumed in England for the last twelve years:—

1833	309,125
1834	405,350
1835	516,132
1836	504,425
1837	517,982
1838	536,440
1839	1,010,193
1840	1,330,295
1841	1,439,742
1842	1,207,920
1843	1,457,456
1844	1,569,120

EXPERIMENT ON ELECTRO-CULTURE AT THE GARDENS OF THE ROYAL BOTANIC SOCIETY.*

BY E. H. SHEPPARD.

We have inserted this account of Mr. Sheppard's experiments, in order that our readers may compare them with the paper in our last number. "In the first week of May I buried in that part of the gardens of the Royal Botanic Society appropriated to agricultural experiments a plate of sheet-copper 2 feet in length, and 9 inches in width, and also at the distance of about 9 feet a plate of zinc of the same dimensions. These plates were both placed in an upright position facing the magnetic north and south, and connected together by means of two copper wires which extended between them at the height of about 3 inches above the ground. Each end of the wires was soldered to the upper corners of the plates, thus forming a galvanic battery, the moist earth completing the circuit.

"Within this parallelogram of ground were sown in rows parallel to the plates, lucerne, sainfoin, clover, red globe turnips, and yellow globe mangold-wurzel. Another parallelogram of ground, of precisely equal size and quality, and at the distance from the former of only 18 inches, and uninfluenced by galvanism, was formed out at the same time, and sown in a similar manner with an equal quantity of seed. No manure whatever was used on either side. In the course of three or four weeks when the seeds had germinated, the difference between the two plots of ground was very obvious; the seeds on the galvanised side failed to a considerable extent, and the mode of their failure was this, that soon after the appearance of the cotyledons above the ground, the young plants began to droop and die off in a peculiar way. In this man-

* *Agricultural Gazette.*

ner the clover and the sainfoin, which had been placed the nearest to the metallic plates, were destroyed to the amount of two-thirds, and the lucerne of one-third; while the mangold-wurzel and the turnips, which were farthest removed from the plates, lost only about one-sixth of their number. These different degrees of injury received by the young plants would, probably, depend upon the separate and relatively tender or more hardy nature of each species. It was, however, at this time evident that a greater amount of galvanic power was generated than is congenial to the germination of these particular seeds.

"All those plants, however, which survived the first five or six weeks continued to live, but, with the exception of the turnips and the mangold-wurzel, they were not at any time so healthy and strong as those on the other plot. But the turnips and the mangold-wurzel, soon presented a different character from the rest, putting on a more vigorous appearance, as well as a more rapid growth, and by the month of August they had acquired a much larger size than the others which were growing in the natural soil. They still contined to increase rapidly in bulk, and by the 20th of October one of the turnips had reached the enormous size of 40½ inches in circumference, and still increasing. This is, I believe, much the largest dimension that this variety of turnip has ever been known to reach. I then began to feel little doubt but that in the succeeding six or eight weeks, during which all such plants continue to increase, it would attain a most unheard-of bulk. But on that day, and when it had begun to excite considerable attention and interest among the Fellows of the Society, a most unfortunate circumstance occurred, and my hopes were doomed to disappointment; for it was then pointed out to me that some person had wantonly thrust a stick into the heart of this fine root.

"This injury put a complete stop to its further growth, and in 10 days afterwards I gave directions that this and all the other plants should be dug up. They were then carefully measured and weighed. The largest turnip was found to measure 40½ inches in circumference, and to weigh 16½ lbs. The aggregate weight of the turnips on the galvanised plot was 27 lbs. On the other plot of ground, and growing naturally, the aggregate weight of the turnips was 5½ lbs. I should mention, however, that one of the turnips on this side had become rotten, and had then been nearly eaten by insects. This was an accidental circumstance, and had it not occurred, about 2 lbs. more in weight would have been added to the last-mentioned amount of 5½ lbs. The aggregate weight of the mangold-wurzel on the galvanised side was 14½ lbs. On the other side, and growing naturally, it was exactly 10 lbs. Thus there existed a large difference between the produce of the two plots of ground; but how far the above increase on the galvanised side was really due to this cause, or to any unknown accidental circumstance of seed or soil, it would seem premature to decide from the result of a single trial. It is a subject that I trust will be followed up by others, and carefully investigated.

"In describing the above experiment, I omitted to state that during its progress I was curious to ascertain if any, and what amount of galvanic power was generated by the metallic plates, and for this purpose I occasionally applied to the wire a very delicate magnetic compass, and I always found that the needle was immediately more or less deflected, evidently showing that an electrical action was constantly kept up. And I was the better enabled to make these observations by the mode of my arrangement of the plates, for as the wires were extended accurately, magnetic north and south, by placing the needle immediately above them the slightest deflection was readily noticed. There were also other motives which led me to adopt this particular arrangement, which it would be impossible to detail within the limits of this paper."

PRESERVATION OF WOOD. PRIORITY OF CLAIM TO THE PROCESS.*

M. Knab writes, in consequence of a recent communication of M. Boucherie, on the preservation of wood, to remind the Academy of the results obtained by M. Margary, during the experiments he made for the same purpose. "These results," says M. Knab, "although known to few persons, are, nevertheless, every day rendering great services to the industrious arts. Margary's process has, in fact, been employed successfully for some years, in England; in France, also it has been usefully applied for the preservation of the sleepers of the Saint-Etienne, Rouen, and Havre, and Bordeaux railroads, and perhaps, at the present moment, a still more general application of it is made in different portions of the works of the atmospheric railroad at St. Germains."

* *Comptes Rendus*, Dec. 15, 1845.

AN INQUIRY INTO THE PRESENCE OF ARSENIC AND COPPER IN WHEAT GROWN FROM SEED THAT HAD BEEN STEEPED IN ARSENIOUS ACID AND SULPHATE OF COPPER.*

BY M. M. J. GIRARDIN.

1. Does arsenic exist in corn grown from seeds that have been steeped in arsenious acid? This question is now generally answered in the negative. Still, as some chemists have declared that they have obtained an opposite result by analysis, I have taken advantage of my possession of a considerable quantity of wheat grown from seed previously impregnated with arsenic, to reconsider this serious question.

I disorganised the seed by means of sulphuric acid—a tedious operation, but one that can be shortened by bruising the seeds in the first instance—I then boiled the carbonaceous mass in a sufficient quantity of nitric acid, and I decanted the clear liquor; the charcoal was washed with boiling distilled water, and the liquid added to the nitric liquor; the whole was concentrated with the successive addition of small quantities of chlorate of potash, until the color was completely removed from the liquid; this last being reduced to a small compass, was boiled with sulphuric acid, to remove all the compounds of nitrogen and chlorine. In this state it was introduced into Marsh's apparatus, the action being kept up for some time, but it gave no trace of arsenic.

I again took some of the charcoal previously washed in nitric acid and water, and I burnt it in a new crucible with an excess of pure nitre. The saline residue was dissolved in water, and decomposed by means of sulphuric acid; the liquid result introduced into a Marsh's apparatus, gave no trace of arsenic.

I repeated these experiments many times, varying the mode of operating, and always acting upon at least two kilogrammes of corn, but I never could discover the least trace of arsenic in the seed, I therefore affirm, that wheat prepared by me with arsenious acid, in 1843 and 1844, produced seeds completely free from arsenic.

2. I wished to ascertain whether corn grown from seeds steeped in a solution of sulphate of copper contained any traces of the last metal. We know from the experiments of Messrs. Springel, Boutigny, and Veyer, that plants cultivated in a soil impregnated with small quantities of sulphate of copper, manifestly contained copper in their organisation.

Consequently, I burnt several kilogrammes of wheat grown from seed previously impregnated with sulphate of copper. The ashes were washed in boiling nitric acid, and the liquid evaporated to dryness. The residue was collected in a very small quantity of water, and in this liquid, slightly acidulated, I left a large polished steel needle for four-and-twenty hours. At the end of that time the needle was covered with a reddish envelope, which, when removed, exhibited by appropriate tests, all the characteristics of copper.

Corn grown from seeds not previouly prepared with sulphate of copper, exhibited very trifling traces of that metal.

Thus, then, in contradiction to what takes place in the case of arsenious acid, wheat prepared with sulphate of copper, produces seed, in which there is always a very perceptible quantity of that metal.

* *Comptes Rendus.*

ELECTRO-GILDING AND PLATING. CLAIM TO PRIORITY OF INVENTION.*

BY M. PERROT.

M. PERROT lays claim to a priority of invention as regards the electro-chemical processes of gilding and silvering, processes which, he says, he discovered when following out the experiments of M. de la Rive, long before the parties to whom they have been ascribed.

"The paper I have the honor of submitting to the Academy," says M. Perrot, "contains, I believe, all the proofs necessary to establish the following propositions:

"1st. In August, 1840, and even before that time, I succeeded in gilding, silvering, and platinizing, iron, steel, and the common metals; I even generalised my processes, and obtained a deposit *with adherence*, of any metal upon another metal.

"2d. I could only arrive at these results by the same processes as those employed by Messrs. Elkington and Ruotz; this is implicitly acknowledged in the report made to the Academy on one hand; and on the other, in a judicial report of Messrs. Pelouze, Chevalier and Barral.

"3d. Two months before, Mr. Elkington, and ten months before M. Ruotz, had proposed, even a partial application of these new electro-chemical processes, I had arrived at results immediately applicable to manufactures. The processes described in the patents afterwards taken out are a repetition, either of the processes I myself employed, or of those already made public by Messrs. Smee, Louyet, Pechiney, Sorel, &c."

* *Comptes Rendus.*

IMPROVEMENTS IN DYEING.*

BY W. NEWTON AND J. MURDOCH.

Two new patents on the subject of dyeing have been recently taken out. These improvements consist principally in the production of sulphuret of lead, which is effected, first, by means of one of the mordants of lead hereafter described (the novel application of which, to the purpose of dyeing, constitutes one improvement), and, secondly, by the employment of sulphuret of calcium.

Sulphuret of calcium is obtained by boiling quick-lime with flowers of sulphur. The mordants in question are the double plumbate of potash and lime, the double plumbate of soda and lime, and the subacetate of lead. By the employment of any one of these mordants, and sulphuret of calcium the following results are obtained:—1st, a slate-gray color, composed solely of sulphuret of lead; 2nd, a fast black dye, having sulphuret of lead for its base: 3rd, a yellow, having for its base chromate of lead. This has been produced before in the art of dyeing; but the mordant employed for that purpose is less economical than those above mentioned.

The following is the mode of obtaining the mordants:—The subacetate of lead is formed by the combination of acetic acid with oxide of lead in excess; the double plumbate of potash and lime is formed by potassiate of lime and oxide of lead; and the double plumbate of soda and lime is formed of the sodate of lime and oxide of lead. All these products are obtained by the processes usually employed in chemistry.

Description of the process of dyeing:—The threads or fabrics of cotton, flax, or hemp, to be dyed, are first to be scoured. They are then steeped in a solution of one of the above-mentioned mordants of lead; and, after being taken out, are allowed to drain; they are then washed with much water. In order to obtain a yellow dye, the threads or fabrics must now be passed through a solution of bichromate of potash, which produces a yellow of greater or less depth, according to the shade required to be obtained.

For a slate-gray, composed solely of sulphuret of lead, the threads or fabrics, after being impregnated with the mordant, are to be dipped in a solution of sulphuret of calcium; the process is finished by softening the shade in the same manner as will be presently described for the black.

For black, the threads or fabrics, on coming from the mordant, are passed through the sulphuret of calcium; they are then washed, and converted into black by means of iron and logwood, as is generally done by the processes pursued in dyeing, which give the shade required in commerce. The dye is finally softened in the ordinary way.

The patentee claims, firstly—the application of sulphuret of lead to the purpose of dyeing cotton, flaxen, and hempen yarns and fabrics. Secondly—the use of the double plumbates of potash and lime, and soda and lime, as mordants, in the process of dyeing; but he lays no claim to subacetate of lead. Thirdly—the application of sulphuret of calcium, as above described, and the method of converting the mordants and the sulphuret of calcium into sulphuret of lead.

The second invention consists in the employment of certain materials as substitutes for cream of tartar, and for the compound of cream of tartar and alum, which are ordinarily used as mordants in dyeing.

The substitute for cream of tartar is composed of muriate of soda or muriate of potash combined with nitric acid; and, instead of alum, sulphate of alumina is used. The mode of preparing the ingredients is as follows:—One hundred pounds of sea salt are mixed with three hundred pounds of water, and when the salt is dissolved, twenty pounds of nitric acid are introduced; and if the mordant is required to be analogous to the compound of cream of tartar and alum, one hundred pounds of sulphate of alumina are to be gradually added to the mixture: the water should be cold, and the mixture but slightly stirred, especially whilst the sulphate of alumina is being added, in order to avoid, as much as possible, the disengagement of nitric and muriatic acid gas, which would injure the quality of the mordant.

The new mordant may be used either in the dye-bath or in the mordant-bath, in the same manner as cream of tartar or cream of tartar and alum. The patentee states, that it will be advisable, as a measure of precaution, to begin the first piece with cream of tartar or cream of tartar and alum, according to the color of the dye-bath, especially for blacks, crimsons, and violets; he recommends, for these colors, the addition of one part cream of tartar to three parts of the new mordant, to prevent the colors from changing.

The patentee claims, firstly—the employment, as a mordant in dyeing, of a compound formed of nitric acid and muriate of soda or muriate of potash. Secondly—the employment of a mordant composed, as in the first claim, with the addition of sulphate of alumina.

* *Newton's London Journal*, Jan. 1846.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

AN ESSAY ON ALCOHOLIC TINCTURES.

BY M. JAQUES PERSONNE.

(*Continued from page* 44.)

4. NUX VOMICA.

						grs.
1 pt. or 15 gr.	by 60 gr.	or 4 pts.	alco. at 80°	total ext. of tinc.		2·69
,,	75 ,,	5 ,,	id.	,,		1·10
,,	60 ,,	4 ,,	56	,,		1·28
,,	75 ,,	5 ,,	id.	,,		1·38
,,	90 ,,	6 ,,	id.	,,		1·32
,,	75 ,,	5 ,,	45	,,		1·44
,,	90 ,,	6 ,,	id.	,,		1·38

QUANTITY OF THE ALKALOID.

In 200 grs. of tinc. made with—

1 pt. nux vomica and 5 pts. alco. at 80°	precipitate obtained		1·126
,, ,,	56	,,	1·382
,, ,,	45	,,	1·042

Alcohol at 56°, being that which dissolves the greatest quantity of strychnine, should be preferred, and also the proportion of 5 pts., being that which furnishes the greatest portion of soluble matters. The Codex prescribes alcohol at 80°.

5. JALAP.

						grs.
1 pt. 15 gr.	by 60 gr.	or 4 pts.	alco. at 90°	total ext. of tinc.		3·75
,,	60 ,,	4 ,,	80	,,		4·44
,,	75 ,,	5 ,,	id.	,,		5·21
,,	90 ,,	6 ,,	id.	,,		5·26
,,	105 ,,	7 ,,	id.	,,		5·29
,,	60 ,,	4 ,,	70	,,		4·36
,,	60 ,,	4 ,,	56	,,		5·50

QUANTITY OF THE RESIN.

100 gr. tinc.	made with 1 pt. jalap and 5 pts.	alco. at 90°	resin obtained	4·38
100	,, ,,	80		4·850
100	,, ,,	70		3·825
100	,, ,,	56		2·745

I should employ alcohol at 80° for the preparation of this tincture, because it was proved by experiment that that degree is the most favorable for the purpose of dissolving the greatest portion of the resin, the active principle, which it is our object to obtain in this medicament. I should also adopt the proportion of 5 parts of this solvent, because the excess of matter dissolved by a larger quantity of the liquid is so trifling that it may be passed over.

The Codex employs alcohol at 56°, which, as we see, dissolves a much smaller proportion of the resin than the preceding.

6. IPECACUANHA.

						grs.
1 pt. 15 gr.	by 75 gr.	or 5 pts.	alco. at 80°	total extr.		2·02
,,	60 ,,	4 ,,	id.	,,		2·12
,,	75 ,,	5 ,,	56	,,		3·02
,,	90 ,,	6 ,,	id.	,,		3·21
,,	75 ,,	5 ,,	id.	,,		3·11
,,	75 ,,	5 ,,	46	,,		1·80

In this case I was not able to ascertain the quantity of the alkaloïd it contained. We know, in fact, that impure emetine is precipitated from its solution by acetate of lead. But we know the great solubility of this alkaloïd in water, which makes its preparation difficult; on this account they have chosen in the Codex alcohol at 56°, for the preparation of this tincture.

This strength of alcohol being that which dissolves the greatest quantity of the matter, as we see in the above table, I should give it the preference, as well as the proportion of 5 parts of this solvent which takes up an excess of matter equal to 0·19.

7. RHUBARB.

								grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco.	at 80°	total ext. of tinc.	6·09
,,	75	,, 5	,,			id.	,,	6·34
,,	60	,, 4	,,			56	,,	6·44
,,	75	,, 5	,,			id.	,,	6·89
,,	90	,, 6	,,			id.	,,	6·81
,,	75	,, 5	,,			45	,,	6·80
,,	90	,, 6	,,			id.	,,	6·74

The two last were extremely mucilaginous.

I endeavored to discover in which of these tinctures the bitterness would remain, after the addition of water. 10 grammes of each of these tinctures, prepared with one part rhubarb and five of alcohol, at 56° and 80°, were diluted with the same quantity of water (400 gr.): the tincture, with the alcohol at 80°, was cloudy, and still rather bitter; that prepared with alcohol at 56° remained transparent, and had no longer a bitter taste; from which we may conclude that alcohol a 80° dissolves more of the active principle.

But, as we know that this tincture is often administered in an undiluted state, in that case alcohol at 80° would be far too strong a spirit. I think, therefore, that it would be better, on this account, as in the Codex, to adopt alcohol at 56° only. I should choose the proportion of five parts of the solvent, which is that which takes up the greatest quantity of extractive matter from this substance.

8. WORMWOOD.

								grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco.	at 80°	total extr.	2·20
,,	75	,, 5	,,			id.	,,	2·67
,,	60	,, 4	,,			56	,,	2·91
,,	75	,, 5	,,			id.	,,	3·58
,,	90	,, 6	,,			id.	,,	3·11
,,	75	,, 5	,,			45	,,	3·53
,,	90	,, 6	,,			id.	,,	3·50

20 grammes of the tincture, prepared with one part of wormwood, and five parts of each of the different degrees of alcohol mentioned above, were diluted with the same quantity of water (400 grammes); the bitter taste of all these tinctures, although much reduced, could still be perceived, but I could not establish the difference in the degree of bitterness presented by each. This fact I had proved by others, not wishing to trust to myself alone.

As all these tinctures possessed the same properties, since it is the bitter principle we are in search of in this medicament, and, as in the preceding case, this tincture is also administered in an undiluted state, I saw no necessity for changing the strength of the alcohol prescribed by the Codex.

I therefore employed alcohol at 56°, in the proportion of five parts, which, as we see in the table, furnishes the greatest quantity of extract.

9. GENTIAN.

								grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco.	at 80°	total extr.	4·75
,,	75	,, 5	,,			id.	,,	4·89
,,	75	,, 5	,,			70	,,	5·34
,,	90	,, 6	,,			id.	,,	5·29
,,	60	,, 4	,,			56	,,	5·24
,,	75	,, 5	,,			id.	,,	5·22
,,	75	,, 5	,,			45	,,	4·95

This substance was tested like the preceding. The tinctures subjected to the proof were also prepared with one part of the substance, and five parts of alcohol of different degrees of strength, and as we were unable to decide upon the difference in the degree of bitterness exhibited by each of these tinctures, after having been diluted with the same quantity of water, I see no necessity for changing the degree of strength adopted in the Codex, especially as this tincture, like the two preceding, is often administered alone. I should, therefore, recommend alcohol at 56°.

Here again, as we see, is an exception to the general rule, which is, that four parts give more extract than five parts, but, I repeat, that as there is certainly an advantage in employing the same proportions in the greatest possible number of cases, I should adopt the proportion of 5 parts of alcohol.

10. FOXGLOVE.

						grs.
1 pt. 15 gr.	by 60 gr.	or 4 pts.	also. at 80°	total extr.		3·65
,,	75 ,,	5 ,,	id.	,,		4·11
,,	60 ,,	4 ,,	56	,,		5·47
,,	75 ,,	5 ,,	id.	,,		5.66
,,	90 ,,	6 ,,	id.	,,		5·80
,,	75 ,,	5 ,,	45	,,		5·02

Instead of alcohol at 80°, as directed by the Codex, I should, in this case, adopt alcohol at 56°, because, as we perfectly well know, especially since the work of M. Homolle, the active principle of digitalis is very readily dissolved by water. For a long time, also, no one has been ignorant of the caution with which tincture of digitalis ought to be administered, on account of its powerful effects. I here also give the preference to the proportion of five parts of the solvent, neglecting the small excess of matter dissolved by six parts.

11. BELLADONNA.

						grs.
1 pt. 15 gr.	by 60 gr.	or 4 pts.	alco. at 80°	total extr.		1·90
,,	60 ,,	4 ,,	56	,,		2·35
,,	75 ,,	5 ,,	id.	,,		2·46
,,	90 ,,	6 ,,	id.	,,		2·49
,,	75 ,,	5 ,,	45	,,		2·50
,,	90 ,,	6 ,,	id.	,,		2·44

We see, in this case, that alcohol at 80° dissolves less matter than alcohol at 56°, and that five parts of the latter dissolve rather more than four. Which of these solvents has dissolved the greatest quantity of the active principle? Atrophine is extremely soluble in concentrated alcohol; but we also know that this active principle also exists in the plant in a state of combination, perfectly soluble in water; on this account, alcohol, at 56°, has been admitted by the Codex in the preparation of this tincture. Besides, the tincture prepared with alcohol at 80° is green, and consequently, loaded with chlorophylle, an inert substance; while the other tinctures contain an imperceptible quantity of this principle. We also see that there is no sensible difference between the quantity of extract obtained by means of alcohol at 56° and alcohol at 45°.

12. STRAMMONIUM.

						grs.
1 pt. 15 gr.	by 60 gr.	or 4 pt.	alco. at 80°	total extr.		2·36
,,	60 ,,	4 ,,	56	,,		3·05
,,	75 ,,	5 ,,	id.	,,		3·16
,,	90 ,,	6 ,,	id.	,,		3·14
,,	75 ,,	5 ,,	45	,,		3·95
,,	90 ,,	6 ,,	id.	,,		4·10

The active principle of this substance, as well as that of belladonna, on the same account, is extremely soluble in water, the Codex, therefore, directs the use of alcohol at 56° in the preparation of this tincture. But these experiments prove that the difference between the quantity of matter dissolved by alcohol at 56° and alcohol at 45°, being 0·81, is sufficient in amount not to be neglected, and that the preference ought to be given to the latter solvent.

The excess of extract furnished by six parts of the solvent is so trifling that it may be neglected, and the proportion of 5 parts can be adopted.

13. HENBANE.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°	total extr.	1·53
,,	60	,,	4	,,	56	,,	3·09
,,	75	,,	5	,,	id.	,,	3·24
,,	80	,,	6	,,	id.	,,	3·29
,,	75	,,	5	,,	48	,,	4·37
,,	90	,,	6	,,	id.	,,	4·24

The Codex has adopted, for the same reason as in the two preceding cases, alcohol at 56°, in the preparation of this tincture; here, also, the excess of matter dissolved by alcohol at 45° is too great to be neglected, since it amounts to 1·08. I, therefore, should employ for these three substances alcohol at 45°, and the proportion of 5 parts of the solvent.

14. HEMLOCK.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°,	total extr.	2·95
,,	60	,,	4	,,	56	,,	4·20
,,	75	,,	5	,,	id.	,,	4·19
,,	90	,,	6	,,	id.	,,	4·23
,,	75	,,	5	,,	45	,,	4·92
,,	90	,,	6	,,	id.	,,	4·86

The Codex, on account of the great solubility in water of the salts of conicine, has adopted alcohol at 56° for this tincture. We perceive in fact a great difference between the quantity of soluble matter taken up by alcohol at 80°, and alcohol at 56°; we also see that there is a difference of 0·69 between the quantity dissolved by the latter, and alcohol at 45°. This excess of soluble matter is perhaps attributable to inert gummy or mucilaginous matters, but, on the other hand, the tincture, with alcohol at 56° is green, and consequently contains chlorophylle, also an inert substance. As in these cases there is a compensation on both sides, I give the preference to the alcohol that furnishes the greatest quantity of soluble matters, and consequently I should adopt alcohol at 45° in the proportion of 5 parts.

15. MONKSHOOD.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alcoat 80°	total extr.	1·98
,,	60	,,	4	,,	56	,,	2·96
,,	75	,,	5	,,	id.	,,	2·95
,,	75	,,	5	,,	45	,,	3·60
,,	90	,,	6	,,	id.	,,	3·65

The second and third of these extracts were rather green, the fourth and fifth were not so.

The Codex directs alcohol at 56° for this tincture, because aconitine existing in the plant, under the form of a salt, like the other alkaloïds, it is consequently easily dissolved in water. On this account I prefer alcohol at 45°, because the excess of matter taken up by the alcohol being 0·65, is large enough not to be neglected. I should also adopt the proportion of five parts of this solvent, being that which furnishes the greatest quantity of extract.

16. SENNA.

							grs.
1 pt.	15 gr.	by	75 gr.	or 5 pts.	alco. at 80°	total extr.	2·54
,,	60	,,	4	,,	56	,,	3·62
,,	75	,,	5	,,	id.	,,	3·70
,,	90	,,	6	,,	id.	,,	3·69
,,	75	,,	5	,,	45	,,	3·96
,,	90	,,	6	,,	id.	,,	4·08

The last two were very mucilaginous.

Agreeing with the Codex, I should give the preference to alcohol at 56°, because it is well known that the active principle of senna (cathartine) is easily dissolved in alcohol and water. I do not adopt alcohol at 45° although it yields a larger quantity of extract, because the tincture obtained with

alcohol of this strength is so extremely viscous, that it is filtered with difficulty, and the excess of product obtained is certainly only due to the mucilaginous matters, which are inert, and uselessly increase the mass; the tincture prepared with alcohol at 56° is equally full flavored, and much less mucilaginous. I should also prefer the proportion of five parts of this solvent, although the quantity of matter dissolved is very small.

17. LEAVES OF THE AZARUM.

						grs.
1 pt. 15 gr. by	60	gr. or	4	pts. alco. at	80° total extr.	1·96
,,	60	,,	4	,,	56 ,,	2·28
,,	75	,,	5	,,	id. ,,	2·99
,,	90	,,	6	,,	id. ,,	3·27
,,	75	,,	5	,,	45 ,,	3·87
,,	90	,,	6	,,	id. ,,	3·69

This substance, as we know, owes its active properties to a principle which is soluble in water (citisine or cathartine), and perhaps, also, to a small quantity of fat oil, and essential oil. The citisine, being extremely soluble in water, we may readily perceive that weak alcohol will have the double advantage of dissolving this substance, and at the same time the greatest portion of the fatty matters which are probably not devoid of action.

I should, therefore, adopt alcohol at 45°, as well as the proportion of 5 for the solvent, which as we see by the table, is that which takes up the greatest portion of the soluble matter.

18. BULBS OF THE MEADOW SAFFRON.

						grs.
1 pt. 15 gr. by	60	gr. or	4	pts. alco. at	56° total extr.	2·56
,,	75	,,	5	,,	id. ,,	2·89
,,	90	,,	6	,,	id. ,,	3·29
,,	75	,,	5	,,	80 ,,	1·79
,,	75	,,	5	,,	45 ,,	3·35
,,	90	,,	6	,,	id. ,,	3·30

The Codex directs alcohol at 56°, for the preparation of this tincture, properly calculating on the fact, that gallate of veratrine, to which this bulb is indebted for its properties, is extremely soluble in water. We also knew that wine, a vehicle containing very little alcohol, and vinegar, readily dissolve the active portion of this substance. I, therefore, give the preference to alcohol at 45°, a liquid containing twice as much alcohol as wine; for, as we see by the table, 5 parts of this vehicle dissolve more of the extractive matters, than 5 parts of alcohol at 56°, the proportion to be employed would also be 5 parts.

19. WHITE HELLEBORE.

						grs.
1 pt. 15 gr. by	60	gr. or	4	pts. alco. at	80° total extr.	3·82
,,	60	,,	4	,,	56 ,,	4·62
,,	75	,,	5	,,	id. ,,	4·87
,,	90	,,	6	,,	id. ,,	4·81
,,	75	,,	5	,,	45 ,,	5·18
,,	90	,,	6	,,	id. ,,	5·27

For the same reason as in the case of the bulbs of meadow saffron, I give the preference to alcohol at 45°, and in the proportion of 5 parts., rejecting to maintain the general rule, on account of the small excess taken up by an additional part of the same solvent; the Codex prescribes alcohol at 56°.

20. VALERIAN ROOT.

						grs.
1 pt 15 gr. by	60	gr. or	4	prts. alco. at	56° total extr.	2·56
,,	75	,,	5	,,	id. ,,	2·89
,,	90	,,	6	,,	id. ,,	3·03
,,	75	,,	5	,,	70 ,,	2·77
,,	75	,,	5	,,	80 ,,	2·32
,,	75	,,	5	,,	45 ,,	3·46
,,	90	,,	6	,,	id. ,,	3·50

Considering that water, and consequently weak alcohol, completely dissolves the valerianic acid, the active principle of the valerian root, I preferred alcohol at 45°, which dissolves the greatest quantity of extractive matter. I also adopt the proportion of 5 parts of this solvent, for 6 parts take up no more extract. The Codex directs alcohol at 56°.

21. SQUILLS.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80° total extr.	3·89
,,	75	,,	5	,,	id.	,,	7·09
,,	75	,,	5	,,	70	,,	9·37
,,	60	,,	4	,,	56	,,	10·21
,,	75	,,	5	,,	id.	,,	10.92
,,	90	,,	6	,,	id.	,,	9·66
,,	75	,,	5	,,	45	,,	10·17

The Codex prescribes alcohol at 56° for this substance; I have not changed the strength of the alcohol, because experiment has proved to me that it is that which best dissolves the soluble parts of the squill, I only adopt the proportion of 5 parts, which, as we see, produces the greatest quantity of extract.

22. BLACK HELLEBORE.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 90° total extr.	3·22
,,	75	,,	5	,,	id.	,,	3·20
,,	75	,,	5	,,	56	,,	4·34
,,	90	,,	6	,,	id.	,,	4·37
,,	75	,,	5	,,	45	,,	2·92

We generally attribute the medical properties of this root to a compound consisting of a volatile acid and a fat substance; on which account alcohol at 80° has been employed for the preparation of this tincture. But if we consider that, according to my experiments, alcohol at 45°, which is the most capable of dissolving the gummy and extractive matters, nevertheless takes up much less of the soluble parts of this root than alcohol at 56°, the conclusion will be, in my opinion, that the last ought to be preferred, for it dissolves a larger quantity than alcohol at 80°. I should even say that alcohol at 56°, as it more readily dissolves the extractive matters, ought to render the solution of the fat substances more easy, because by the disintegration of the extractive matters, it will find itself in close contact with the first. Probably, also, these extractive matters once dissolved, may assist in the solution of the others. Do we not every day see this effect produced, when we treat with water substances containing a mixture of these different substances? The water extract of guaiacum, for example, contains resin, which certainly has been removed by the extractive principle.

I, therefore, give the preference to alcohol at 56° and the proportion of five parts, for it is evident we may neglect the small excess of matter dissolved by one more part of this solvent.

23. ROOTS OF ASARUM.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80° total extr.	1·90
,,	75	,,	5	,,	id.	,,	1·00
,,	60	,,	4	,,	56	,,	3·34
,,	75	,,	5	,,	id.	,,	3·29
,,	90	,,	6	,,	id.	,,	3·30
,,	75	,,	5	,,	45	,,	3·09

I should adopt alcohol at 56° for this tincture, because at that strength it takes up more of the soluble matters, and the root contains rather more of the fatty principle than the leaves. I also recommend the proportion of five parts of this vehicle, although only four parts would be sufficient, as we see by the table. What makes me prefer this proportion, is the fact that this tincture is but little employed, and more particularly to avoid the inconvenience of multiplying these different proportions of alcohol.

24. CONTRAYERVA.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr. 1·15
,,	75	,,	5	,,		id.	,, 1.31
,,	75	,,	5	,,		56	,, 2·29
,,	90	,,	6	,,		id.	,, 2·22
,,	75	,,	5	,,		45	,, 1·57

No analysis having as yet shown the nature of the active principle of this substance, I choose that degree of strength which furnishes the greatest portion of soluble matter, and consequently I select alcohol at 56°, and the proportion of five parts, which is that which dissolves most of the substance.

25. MILK WORT.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr. 4·88
,,	75	,,	5	,,		id.	,, 5·06
,,	75	,,	5	,,		56	,, 6·27
,,	90	,,	6	,,		id.	,, 6·36
,,	75	,,	5	,,		45	,, 6·09

Water, as we know, readily dissolves the active principle of polygala, poligallic acid, I should, therefore, give the preference to alcohol at 56°, which furnishes the greatest quantity of extract, and is certainly preferable to alcohol at 80° for the extraction of this principle, because the pectic acid, gum, and albumen contained in this root, are certainly coagulated by this last vehicle, and thus prevented coming in contact with the active matter; and as we may also reject the trifling excess of matter dissolved by six parts of alcohol, I choose the proportion of five parts of this solvent.

26. PELLITORY OF SPAIN.

							grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr. 1·24
,,	75	,,	5	,,		id.	,, 1·82
,,	90	,,	6	,,		id.	,, 1·64
,,	75	,,	5	,,		90	,, 1·20
,,	60	,,	4	,,		56	,, 2·13
,,	75	,,	5	,,		id.	,, 2·20
,,	75	,,	5	,,		45	,, 2·18

The first four of these extracts are extremely resinous, the three last only so in a trifling degree.

As the active principle of this substance is solely due to a resinous matter, insoluble in water, I have not changed the strength of the alcohol recommended in the Codex. In fact, I am convinced that in dissolving the extracts obtained, those prepared by strong alcohol were extremely resinous, while, on the contrary, those prepared by weak alcohol were much less so.

I, therefore, recommend alcohol at 80°, giving a preference to the proportion of 5 parts of this solvent, being that which takes up the greatest quantities of the soluble parts of the root.

(To be continued).

CASE OF POISONING WITH THE BICHLORIDE OF MERCURY.

BY WILLIAM BIRD HERAPATH.

THE following case of poisoning by the bichloride of mercury in solution presents many interesting peculiarities. It occurred recently in the practice of my partner, Mr. S. Bryant, and myself; we watched it closely throughout, but, from peculiar circumstances were unable to render the Patient all the assistance we wished:—

SUMMARY OF THE CASE.

1st Day.—An attenuated epileptic patient swallowed a fluid containing a scruple of bichloride of mercury in solution. Vomiting came on in two minutes afterwards, and diarrhœa in fifteen, which continued during an hour. Stomach-pump used, and albumen injected.

2nd. — Diarrhœa continued; vomiting ceased; system rallied from the shock.

3rd.—Diarrhœa ceased; suppression of urine, and ptyalism came on.

4th.—Ptyalism and suppression continued.

5th.—Diarrhœa, disentery, and tenesmus came on; great prostration and violent pain; sloughing of the gums, lips, and tongue.

6th.—Rallied; tenesmus continued; febrile excitement came on in the evening.

7th.—Excitement of the vascular system continued.

8th.—Excitement passed off; coma came on; convulsions followed. Jactation and trembling ceased.

9th.—Coma increased; convulsions more frequent; prostration; congestion of the lungs; respiration became embarrassed.

10th.—Death occurred early.

Autopsy.—Œsophagus healthy; stomach inflamed; mucous membrane injected and extensively softened; some blood effused; vascularity of small intestines; cæcal extremity of ileum almost gangrenous; cæcum most highly inflamed, gangrenous, and sloughing; sigmoid flexure of colon and rectum also ulcerated, sloughing, and much inflamed; lungs congested, lobular pneumonia of the left.—*Lancet.*

AN ANALYSIS OF THE MANNAS OF COMMERCE.*

BY M. LEUCHTWEISS.

The author has examined the varieties of manna most frequently met with in commerce. 1st, the manna canellata—flaked manna; 2nd, manna canellata—manna in lumps; 3rd, manna calabrina—capacy manna.

The following are the substances he met with, and the relative proportions of each of them:—

MANNITE.

To obtain this substance, he destroyed the sugar the mannas contained by means of fermentation, he evaporated the mass until it was dry; the residue, when treated with alcohol, yielded the mannite, which in manna in tears, amounted to as much as 42·6 per cent., while in the capacy manna it was no more than 32 per cent.

SUGARS.

The author thinks it is grape sugar, and he calculated the quantity the mannas contained, by the volume of carbonic acid produced by fermentation; the quantity of sugar varied from 9 to 15 per cent.

M. Leuchtweiss also ascertained the presence of a mucilaginous substance, a small quantity of resin, and an organic acid, altogether amounting to from 40 to 42 per cent.

These mannas contained from 11 to 13 per cent. of water, a considerable proportion as we see. Lastly, by adding together the ashes obtained by the calcination of the insoluble matters, a total of from 1·5 to five per cent. was obtained.

The following is a table of the comparative analysis of three varieties of manna:—

	I. Manna Canellata in flakes.	II. Manna Canellata in the lump.	III. Manna Calabrina.
Water.....	11·6	13·0	11·1
Insoluble matter..	0·4	0·9	3·2
Sugar	9·1	10·3	15·6
Mannite	42·6	37·6	32·0
Mucilaginous matter, resin, organic acid, azotised substances	40·9	40·8	42·1
Ashes	1·3	1·9	1·0

We see by this table that the manna canellata is the purest and richest in mannite, after that follows the manna canellata in lumps, and, lastly, the manna calabrina.

* *Journal de Pharmacie.*

FORMULA OF THE OINTMENT USED AS A REMEDY AGAINST ECZEMA.*

BY DEVERGIE.

The following is the composition of an ointment which has been recognised, with justice, by all practitioners as particularly useful in quieting the violent itching sensation in eczema.

℞.—Lard ..... 30 grammes.

Calomel, from 2 to 4 grammes.

Camphor, from 25 to 50 centigrammes.

The camphor must be dissolved in a few drops of alcohol, before it is mixed with the lard.

After the eczema has reached its last stage, the object is to restore the skin to its natural color, to give it its former firmness, to restore its tone as it were. For this purpose various kinds of ointment may be employed, in one of these tannin is introduced.

℞.—Lard ..... 30 grammes.

Tannin ..... 4 grammes.

Other may be employed, but in that case ointments a fourth or fifth of their weight of lard must not be prescribed, but a smaller proportion after the following formula:—

℞.—Lard 50 grammes.

Tan, from 5 decigrammes to 1 gramme.

The tar has great resolving power, but it it is also extremely exciting to an eczematous surface.

* *Journal de Pharmacie.*

ON THE ACTION OF BITTER ALMONDS, THE LEAVES OF THE CHERRY-LAUREL, PEACH BLOSSOMS, AND THEIR DISTILLED WATERS. ON ESSENTIAL OILS, AND AROMATIC SUBSTANCES IN GENERAL.*

BY M. MAHER.

THE notice already taken of the disappearance of the smell of musk in syrup of orgeat, as established by M. Soubeiran, and recognised afterwards in the case of cherry-laurel water, by M. Fauve, of Bordeaux, led me to generalise this action upon essential oils, and all strongly scented substances.

Without being able to add to the stores of science anything as to the cause, the experiments I am about to mention may be of interest, if it were only to point out a quick and easy method of cleansing and rendering fit for any use, bottles, or vessels of any kind, which can, in many cases only be used for the substances by which they were infected.

Very lately I wished to avoid the trouble of the sweetening, always imperfect and disagreeable, of a marble mortar I had used for the preparation of an assafœtida lotion, by means of vinegar, and afterwards of ashes. I though of trying the residuum of some almond paste, which I had just employed in the preparation of orgeat; and having taken a portion and rubbed my mortar with it, as the smell still remained, I added a little water, when a strong odour of bitter almonds was perceptible; I rubbed it again, washed it with a quantity of water and the smell had completely disappeared.

This first attempt induced me a few days afterwards, to apply the same plan to phials and bottles which had held camphorated eau-de-vie, oil of spike, essence of cloves, peppermint, orange, lavender, lemon, and turpentine, and the oils of petrolium, copahu, cod's liver, creosote, and a number of odoriferous, balsamic, and resinous substances.

All these bottles were cleansed, without smell, and as if new.

But it was necessary, in the first instance, to remove the grease from those which were oily, by means of pearlash or potash, and to rinse those which contained resinous and balsamic tinctures, with alcohol, before you used the almond paste. It is clear that pure bitter almond paste, without sweet almonds, would succeed better when used in the same quantity; but the article usually sold will not succeed so well, as much, frequently, on account of its age as of its having been adulterated with bran, flour, &c.; but fresh cakes of bitter almonds may easily be procured and pulverised for the purpose.

The leaves of the cherry-laurel, and of the peach, if bruised, and reduced to a pulp, and introduced into the bottles, act in the same manner. A handful of these leaves, rubbed upon the sides of a mortar, or any other scented vessel, have, using a little water, succeeded with me as well as bitter almonds.

The distilled waters of bitter almonds, cherry-laurel, and peach, especially if they are recent, have the same effect if the same precautions are used, but it is more expensive to employ them.

It must be the same in the case of all seeds, flowers, or leaves, that contain hydrocyanic acid, even with other odoriferous substances that have not as yet been experimented on. This explains the common practice of applying laurel leaves to new jars and other vessels, either by placing them in an oven, or boiling them in water.

After these trials I think I may assert that the paste of bitter almonds, or a pulp of the flowers of the laurel or the peach, may become applicable to the preservation of fish and meat during their transport, and act as a condiment to them; that their distilled waters may improve the smell in dissecting amphitheatres, newly painted apartments, and rooms in hospitals. I am above all convinced of their success in removing the musty smell from vessels, and even barrels, by giving them some time to act, and frequently agitating them on account of the porous nature of the wood.

It remains now to be ascertained whether the action of hydrocyanic acid can or cannot modify the medical properties of odorous substances; it is the business of medical men to ascertain whether they ought not to suppress cherry-laurel water and syrups of orgeat, in draughts, containing distilled waters or aromatic substances.

* *Journal de Chimie.*

ON THE PROPERTIES OF THE LEAVES OF THE OXALIS CRASSICAULIS, AND THEIR USE AS AN ASTRINGENT, PARTICULARLY IN HEMORRHAGE AND CHRONIC CATARRH.*

THE oxalis is a plant originally brought from Peru; but it has for some time been employed in Europe. Dr. Montain has drawn attention to this plant in the last number of the *Journal de Médecine*, of Lyons. There

* *Journal de Pharmacie.*

are several varieties; but the oxalis crassicaulis is that which possesses the most decided effect. Its tubers, which are very abundant, afford an agreeable and nourishing article of food. Its stems and leaves are numerous and succulent, fit to eat, and cultivated in Peru for that purpose. But their most remarkable property is their therapeutic action; they furnish the materia medica with an extremely astringent juice, which has often succeeded with M. Montain, when other agents of the same nature have failed.

The juice of the leaves is of a powerful, but agreeable, acid, it is very abundant, and can be preserved without spoiling. The following is the method by which it is obtained:—A little before the frost sets in, the stems of the oxalis are collected, they are submitted to strong pressure, and a quantity of juice is extracted, calculated at three-fourths of the weight of the stalks and leaves employed. After this, by macerating what remains in a certain quantity of water, you may still obtain a liquid sufficiently acid to be used as a weak astringent.

The juice readily mixes with sugar, and forms an acid syrup, of a slightly aromatic flavour. M. Montain prescribes this juice, either pure or sweetened, or in different proportions, when mixed with some other substance. He has specially used it inwardly in doses of from 3 to 6 spoonfuls a day; he has sometimes prescribed it in lavements or injections.

The diseases that appear to have been chiefly affected by the action of this medicament, are the following:—Hemorrhage of the womb, either passive or chronic, and most fluxes of the same nature, not always connected with organic disease. A continuance of the medicine from five to fifteen days has often been sufficient to stop or to reduce hemorrhages of this nature, that have existed for months and even years. Fluxes of blood from the rectum, and two cases of ruptured blood vessels have been cured by this means; chronic catarrhs, diarrhœa and dysentery, in particular, have been treated with advantage by the juice of the oxalis, either pure or taken in geneva. It has even been given in old cases of gonorrhœa, particularly those which have resisted the action of copaiba.

The oxalis belongs to the natural family of the Geranidæ, and must not be confounded with the rumex acetosa of the family of the Poligonæ. M. de Candolle has formed them into a new group under the name Oxalidæ. The oxalis crassicaulis produces large stems, which are cut in November, for the purpose of expressing the juice; the tubers are then left for three or four months to increase and harden. One of these, alone, is sufficient to produce several hundreds, and a plot of ground three metres square, is sufficient to furnish as much as 80 litres of pure juice.

BOLOGNA CATECHU, PARTIGLIE DI TERRA CATECU AROMATICA OF THE ITALIANS.*

BY M. DORVAULT.

The following formula for this preparation is of Italian origin:—

Extract of liquorice by infusion	*aa* 10 grammes.
Water	

Place it in a sand-bath, and add,

Bengal catechu, in powder	30 grammes.
Gum, in powder	15 grammes.

Evaporate it to the consistence of an extract, and then incorporate the following powders, which must be exceedingly fine:—

Mastic	*aa* 2 grammes.
Cascarilla	
Charcoal	
Florence iris	

Let the mass become of a proper consistence, remove it from the fire, and add,

English essence of peppermint	2 grammes.
Tincture of amber . ..	*aa* 5 drops.
Tincture of musk	

Pour it on to a slab of marble, previously greased, and roll it out by means of a rolling pin to the thickness of a half-franc piece. When the mass is cold, rub it with a piece of blotting-paper, to remove the oil completely from both surfaces; then slightly moisten both sides, and spread silver leaf over them; allow it to dry; cut the sheet into narrow strips, afterwards cut the strips into very small squares or lozenges (about the size of the seeds of fanugrec).

The catechu that is brought from Italy is contained in small oval deal boxes, weighing about 20 grammes, and covered with a large seal of red sealing-wax.

We do not give this receipt as the true one—the latter appears to be the secret of one or two Bolognese pharmacopolists—but merely as a formula producing an article that will in every respect answer the purpose of the Italian preparation.

The Bologna catechu is a pleasantly-tasted preparation; it is as frequently taken as a sweetmeat, as a medicine, and we must attribute to it the tonic and carminative pro-

* *Journal de Pharmacie.*

parties of the substances of which it is composed.

Two or three pastilles, or grains, are sufficient to give the breath the most agreeable perfume and freshness.

The Bologna catechu corrects the bad breath caused by affections of the stomach, decayed teeth, &c.; and smokers frequently use it to conceal the smell of tobacco. In most parts of Italy the richer classes always carry it about with them, and take it as a pastime.

TREATMENT OF EPILEPSY BY DIGITALIS.*

BY D. J. CORRIGAN, M.D.

FOXGLOVE has been, from time immemorial, a quack remedy, in the rural districts of Ireland, for epilepsy. Its effects, as administered by the women who profess to cure the disease, have been so violent, that the profession has shrunk from its administration, although success had in many instances followed on its exhibition. The following is the formula which is generally used:—Fresh leaves of digitalis, four ounces; beat into a pulp, and pour over it a pint of boiling beer; infuse for eight hours, and strain with expression. Of this give, every third day, four ounces, with fifteen grains of dried root of polypodium. In another formula the dose is to be repeated every third hour until vomiting is produced. In 1828, Sir P. Crampton informed Dr. Corrigan that he had superintended its exhibition in four cases, and that in three of these it had been successful, but that he did not venture beyond the first dose, its effects were so violent. It caused violent and continuous vomiting like that of seasickness, which continued incessantly for 24 hours, with irregularity and feebleness of pulse that remained for several weeks after. In the year 1831, Dr. Sharkey, of Cork, in a paper in the *Lancet*, drew the attention of the profession to its good effects in the disease, given according to a similar formula. The effects of a single dose (four ounces) were vomiting, soreness of epigastrium, cold extremities, cramps, and great depression and irregularity of pulse, continuing for several days. The author gave the remedy himself in the same form, and is not surprised that the profession should shrink from employing it. The first dose produced the most violent vomiting, followed by cold sweats, feeble and irregular pulse, and these symptoms again by intense gastritis, accompanied with great sinking of the vital powers, and double vision, which continued for several days, sufficient to deter him from ever again venturing upon its administration in such a dose.

There are some circumstances connected with the effects of this large dose that may be worth noticing here; it was given at ten o'clock, A.M.: at twelve o'clock the pulse had fallen thirty beats, viz., from eighty-six to fifty-six, and there was slight headache, with very slight nausea: it was not until eight o'clock, P.M., ten hours after the administration of the dose, that the violent symptoms set in. It then occurred to Dr. C. that as it is a remedy possessing a cumulative property, he might succeed in saturating, as it were, the nervous system with its sedative influence, without the risk of inducing those frightful effects which follow on the sudden exhibition of the large dose; and he believes that he can now venture to say that this important point in practical medicine can be gained. After many trials of its preparations, he gives the preference to the infusum digitalis of the Dublin Pharmacopœia, but he cannot too strongly insist on the necessity of the greatest attention being paid to see that the leaves are well prepared, and of the latest gathering. The mode of administration is to begin with ʒj. of the infusion every night at bed-time, increasing it after a week to ʒiss., and after another week to ʒij., beyond which it is rarely necessary to go, and continuing it until sickness of the stomach and dilated pupils are observed, when the dose is to be diminished by ʒss. or ʒj. until the maximum dose that can be borne without inconvenience is ascertained, at which the administration is to be continued for two or three months. Given in this way, its exhibition is attended with no inconvenience beyond an occasional attack of slight sickness of stomach in the morning, or headache, &c., when the medicine is to be omitted, and a day or two are to be allowed to pass over before resuming its use. With the exception of these symptoms, there is no perceptible effect, beyond slow action of the heart, and the patient during its use is able to follow his ordinary avocations. Two cases are related, but as the paper is to be continued, Dr. Corrigan will probably lay others before the profession. The first is that of a gentleman, æt. 27, who during the previous seven months had suffered from repeated attacks of epilepsy, followed by delirium. He was kept under the influence of the medicine for about five months, when the attacks having gradually become milder and milder, at length ceased altogether. The patient has remained without a return of the disease for four years. In the second case the effects were only watched for about six weeks, but even in this time the attacks had ceased.

*. *Dublin Hospital Gazette.*

CHLORINE IN SCARLATINA.*

BY CHARLES MAITLAND, M.D.

The administration of chlorine in scarlatina, recently recommended by various practical writers, is attended with a theoretical difficulty which is likely to prevent many from fully testing its power of disinfecting the poisoned secretions. I refer to its liability to produce corrosive sublimate, by combination with calomel previously introduced into the system. My object in troubling you with this paper is twofold:—to draw the attention of your readers to the remedy, and its mode of exhibition; and also to obtain from those who have tried it, such assurance of its safety, or description of the cautions necessary, as may embolden others to employ it.

The formula for preparing chlorine in solution is given in Dr. Watson's "Lectures on the Practice of Physic," vol. ii., p. 764, second edition. A drachm of chlorate of potash is there ordered to be dissolved in an ounce of hydrochloric acid, previously diluted with an ounce of water. This proportion of water is too small, being neither sufficient to dissolve the chlorate nor to retain the gaseous chlorine in solution at the ordinary temperature of a chemist's shop. I should therefore recommend two ounces of water to insure uniformity, and this in addition to the usual precaution of a well-stoppered bottle, and a dark place for its preservation.

That such a solution of chlorine, even when highly diluted, will convert calomel into corrosive sublimate is easily proved. After some preliminary experiments, made to determine the general fact, I mixed together six minims of Dr. Watson's solution of chlorine, two ounces of water at 60°F., and two grains of calomel. After ten minutes, a drop of the fluid placed upon polished gold, and touched with a steel point, yielded a perceptible amalgam; and after fifteen minutes a decided amalgam was formed. After thirty minutes, iodide of potassium gave a pale scarlet precipitate.

A similar mixture at the temperature of 98°F. yielded traces of mercury by the amalgam test, after five minutes' digestion.

Two ounces of warm infusion of tea, with some tea-leaves, milk, and sugar, were mixed with six minims of solution of chlorine, and two grains of calomel. After an hour, all smell of chlorine had disappeared, and no trace of amalgam could be obtained during the next sixteen hours.

From these experiments, it would seem that the formation of corrosive sublimate by the co-administration of chlorine and calomel, depends upon the amount of organic matter present in the stomach and bowels; a condition which materially affects also the disinfecting power of chlorine, if we may judge of the processes within the body by that which takes place without it. Experience, therefore, must decide the question, whether chlorine can be both safely and effectively given to persons already influenced by mercury, or taking it at the time.

After fasting for five hours, I took at bedtime two grains of calomel, and immediately after three ounces of water, containing six minims of the solution of chlorine. A dull pain and heat over the umbilical region during the night, with the griping usually attributed to the action of mineral acids together with mercury, were the only unpleasant symptoms that followed; but next day there were slight coppery taste, looseness of the teeth, and a little gray edging to the gums, never before produced by the same dose of calomel alone. There is, therefore, reason to suppose, that if followed up by repeated doses of solution of chlorine, the *Draco mitigatus* would have altogether forfeited its claim to the appellation, and under some circumstances disagreeable results might occasionally follow.

Should this paper meet the eye of Dr. Watson, it is hoped that he will be kind enough to supply any information which he may possess on this point, and thereby add to the obligations which he has already conferred on the profession, by the many valuable suggestions contained in his truly practical work.

* *Lancet*, Jan. 10, 1846.

THE MEANS OF ASCERTAINING THE EFFICACY OF DIGITALIS.

BY M. FALKEN.

According to M. Falken, the following plan is a means of ascertaining, in an infallible manner, whether or not digitalis possesses its virtues.

50 centigrammes of the powder of the leaves of digitalis are to be infused in boiling water, and after an hour to be strained off. When cold 20 to 30 drops of a solution of ferrocyanide of potash are added, prepared with 75 centigrammes of this salt, to 35 grammes of distilled water.

If the digitalis is active, the infusion becomes rather clouded, but if this cloud does not appear before ten or fifteen minutes, we may consider the digitalis as not possessing a sufficient degree of activity.

According to M. Falken, the digitalis grown in Switzerland has proved the most active.

ADULTERATION OF DRUGS.

1. State of Mercury in the compound Pills of Chloride of Mercury.
2. Oxysulphuret of Antimony, an Antidote for the Bichloride and Chloride of Mercury.
3. Adulteration of the Oxysulphuret of Antimony.

To the Editors of The Chemist.

GENTLEMEN,—For some time past I have had repeated opportunities of comparing the action of one grain of chloride of mercury with that of the compound pills of chloride of mercury of the London Pharmacopœia in the dose of five grains, which is said to contain rather more than one grain of the chloride. The former acted as an active purgative, but the latter produced little or no action on the bowels when taken by the same individual.

I knew a gentleman who took a five-grain pill of the compound every night for more than a year, also a lady who took one, and sometimes two, daily, for nine months without any perceptible effect.

From these observations I was induced to examine the compound, which I found, when in a moist state, to contain an uncombined acid. By treating the mass with water, chlorine was held in solution, owing to the decomposition of the chloride of mercury by the oxysulphuret of antimony. The sulphur unites with the mercury, forming almost an inactive compound, and the free chloride remains in solution, owing to the chloride of antimony being insoluble in water. Sulphur has a greater affinity for antimony than it has for mercury; but the chloride having a greater affinity for antimony than it has for mercury, the decomposition of the calomel is effected.

I would beg to suggest the propriety of omitting the chloride of mercury in the compound pills, and substituting sulphuret of mercury, which would enable the practitioner to see more clearly the nature of the remedy which he prescribes, without being misled by the decomposition which takes place. I consider the pills are not entitled to the name "pilulæ hydrargyri *chloridi* compositæ," because the mercury is no longer a chloride when the pills are in a moist state or dissolved in the stomach.

The result of these experiments induced me to try the action of oxysulphuret of antimony on the bichloride of mercury, when I found about five parts of the former capable of decomposing one part of the latter, simply by triturating the mixture in a mortar with distilled water for a few minutes. The filtered liquid being tested, free chlorine was held in solution, but no trace of the bichloride of mercury could be detected, even when the sediment was treated with hydrochloric acid.

I am not aware that the oxysulphuret of antimony has ever before been introduced as an antidote for the bichloride of mercury; but I am of opinion that it will be found equal if not more efficacious than albumen, owing to the absorbent property of the oxysulphuret in small doses, and acting as an emetic in large doses would cause this poison to be rejected as well as decomposed. The oxysulphuret should be given in water in the above proportions, according to the quantity of the poison taken as near as can be ascertained, and afterwards administered in small doses. It must be observed that the antidote is incapable of decomposing any other preparation of mercury, except the bichloride and the chloride.

The above experiments led me to a third investigation. I found the liquid containing chlorine yielded, by evaporation, a quantity of small white insoluble crystals, which I found upon examination were composed of sulphate of lime. How sulphate of lime could possibly exist in the oxysulphuret of antimony was scarcely credible, no lime being used in preparing it. But chemistry is able to solve many mysteries which the eye, taste, and smell are unable to detect. I regret, therefore, to be under the necessity of bringing before the public another disgraceful system of adulteration practised by some of the manufacturing chemists. The base practice carried on by some of these persons, is not only a degradation to themselves and to our nation, but I consider they are guilty of hurrying many individuals to an early grave. It is impossible for the practitioner to prescribe for his patient with any degree of certainty, the effects of course must be directly opposite to that which he expects.

I have proved by experiment that the oxysulphuret is not simply mixed with the sulphate of lime, but a malicious cunning system is adopted in the laboratory in order to avoid detection. The antimony is boiled in the Pharmacopœia to be boiled with a solution of potash, instead of which *lime* is substituted, and sulphuric acid being added, the oxysulphuret of antimony is precipitated, in combination with about 30 per cent. of sulphate of lime (gypsum).

In the old Pharmacopœia, the pilulæ hydrargyri chloridi compositæ was ordered to be made into a mass with rectified spirit, which sometimes prevented the pills from dissolving in the stomach; this, I believe, may

13, HENBANE.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°	total extr.	1·53
,,	60	,,	4	,,	56	,,	3·09
,,	75	,,	5	,,	id.	,,	3·24
,,	80	,,	6	,,	id.	,,	3·29
,,	75	,,	5	,,	48	,,	4·37
,,	90	,,	6	,,	id.	,,	4·24

The Codex has adopted, for the same reason as in the two preceding cases, alcohol at 56°, in the preparation of this tincture; here, also, the excess of matter dissolved by alcohol at 45° is too great to be neglected, since it amounts to 1·08. I, therefore, should employ for these three substances alcohol at 45°, and the proportion of 5 parts of the solvent.

14. HEMLOCK.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°,	total extr.	2·95
,,	60	,,	4	,,	56	,,	4·20
,,	75	,,	5	,,	id.	,,	4·19
,,	90	,,	6	,,	id.	,,	4·23
,,	75	,,	5	,,	45	,,	4·92
,,	90	,,	6	,,	id.	,,	4·86

The Codex, on account of the great solubility in water of the salts of conicine, has adopted alcohol at 56° for this tincture. We perceive in fact a great difference between the quantity of soluble matter taken up by alcohol at 80°, and alcohol at 56°; we also see that there is a difference of 0·69 between the quantity dissolved by the latter, and alcohol at 45°. This excess of soluble matter is perhaps attributable to inert gummy or mucilaginous matters, but, on the other hand, the tincture, with alcohol at 56° is green, and consequently contains chlorophylle, also an inert substance. As in these cases there is a compensation on both sides, I give the preference to the alcohol that furnishes the greatest quantity of soluble matters, and consequently I should adopt alcohol at 45° in the proportion of 5 parts.

15. MONKSHOOD.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alcoat 80°	total extr.	1·98
,,	60	,,	4	,,	56	,,	2·96
,,	75	,,	5	,,	id.	,,	2·95
,,	75	,,	5	,,	45	,,	3·60
,,	90	,,	6	,,	id.	,,	3·65

The second and third of these extracts were rather green, the fourth and fifth were not so.

The Codex directs alcohol at 56° for this tincture, because aconitine existing in the plant, under the form of a salt, like the other alkaloïds, it is consequently easily dissolved in water. On this account I prefer alcohol at 45°, because the excess of matter taken up by the alcohol being 0·65, is large enough not to be neglected. I should also adopt the proportion of five parts of this solvent, being that which furnishes the greatest quantity of extract.

16. SENNA.

							grs.
1 pt.	15 gr.	by	75 gr.	or 5 pts.	alco. at 80°	total extr.	2·54
,,	60	,,	4	,,	56	,,	3·62
,,	75	,,	5	,,	id.	,,	3·70
,,	90	,,	6	,,	id.	,,	3·69
,,	75	,,	5	,,	45	,,	3·96
,,	90	,,	6	,,	id.	,,	4·08

The last two were very mucilaginous.

Agreeing with the Codex, I should give the preference to alcohol at 56°, because it is well known that the active principle of senna (cathartine) is easily dissolved in alcohol and water. I do not adopt alcohol at 45° although it yields a larger quantity of extract, because the tincture obtained with

alcohol of this strength is so extremely viscous, that it is filtered with difficulty, and the excess of product obtained is certainly only due to the mucilaginous matters, which are inert, and uselessly increase the mass; the tincture prepared with alcohol at 56° is equally full flavored, and much less mucilaginous. I should also prefer the proportion of five parts of this solvent, although the quantity of matter dissolved is very small.

17. LEAVES OF THE AZARUM.

							grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco. at 80°	total extr.	1·96
	,,	60 ,,	4	,,	56	,,	2·28
	,,	75 ,,	5	,,	id.	,,	2·99
	,,	90 ,,	6	,,	id.	,,	3·27
	,,	75 ,,	5	,,	45	,,	3·87
	,,	90 ,,	6	,,	id.	,,	3·69

This substance, as we know, owes its active properties to a principle which is soluble in water (citisine or cathartine), and perhaps, also, to a small quantity of fat oil, and essential oil. The citisine, being extremely soluble in water, we may readily perceive that weak alcohol will have the double advantage of dissolving this substance, and at the same time the greatest portion of the fatty matters which are probably not devoid of action.

I should, therefore, adopt alcohol at 45°, as well as the proportion of 5 for the solvent, which as we see by the table, is that which takes up the greatest portion of the soluble matter.

18. BULBS OF THE MEADOW SAFFRON.

							grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco. at 56°	total extr.	2·56
	,,	75 ,,	5	,,	id.	,,	2·89
	,,	90 ,,	6	,,	id.	,,	3·29
	,,	75 ,,	5	,,	80	,,	1·72
	,,	75 ,,	5	,,	45	,,	3·35
	,,	90 ,,	6	,,	id.	,,	3·30

The Codex directs alcohol at 56°, for the preparation of this tincture, properly calculating on the fact, that gallate of veratrine, to which this bulb is indebted for its properties, is extremely soluble in water. We also know that wine, a vehicle containing very little alcohol, and vinegar, readily dissolve the active portion of this substance. I, therefore, give the preference to alcohol at 45°, a liquid containing twice as much alcohol as wine; for, as we see by the table, 5 parts of this vehicle dissolve more of the extractive matters, than 5 parts of alcohol at 56°, the proportion to be employed would also be 5 parts.

19. WHITE HELLEBORE.

							grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco. at 80°	total extr.	3·82
	,,	60 ,,	4	,,	56	,,	4·62
	,,	75 ,,	5	,,	id.	,,	4·87
	,,	90 ,,	6	,,	id.	,,	4·81
	,,	75 ,,	5	,,	45	,,	5·18
	,,	90 ,,	6	,,	id.	,,	5·27

For the same reason as in the case of the bulbs of meadow saffron, I give the preference to alcohol at 45°, and in the proportion of 5 parts., rejecting to maintain the general rule, on account of the small excess taken up by an additional part of the same solvent; the Codex prescribes alcohol at 56°.

20. VALERIAN ROOT.

							grs.
1 pt	15 gr.	by 60 gr.	or 4	prts.	alco. at 56°	total extr.	2·56
	,,	75 ,,	5	,,	id.	,,	2·89
	,,	90 ,,	6	,,	id.	,,	3·03
	,,	75 ,,	5	,,	70	,,	2·77
	,,	75 ,,	5	,,	80	,,	2·82
	,,	75 ,,	5	,,	45	,,	3·46
	,,	90 ,,	6	,,	id.	,,	3·50

Considering that water, and consequently weak alcohol, completely dissolves the valerianic acid, the active principle of the valerian root, I preferred alcohol at 45°, which dissolves the greatest quantity of extractive matter. I also adopt the proportion of 5 parts of this solvent, for 6 parts take up no more extract. The Codex directs alcohol at 56°.

21. SQUILLS.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°	total extr.	3·89
,,	75	,,	5	,,	id.	,,	7·09
,,	75	,,	5	,,	70	,,	9·37
,,	60	,,	4	,,	56	,,	10·21
,,	75	,,	5	,,	id.	,,	10.92
,,	90	,,	6	,,	id.	,,	9·66
,,	75	,,	5	,,	45	,,	10·17

The Codex prescribes alcohol at 56° for this substance; I have not changed the strength of the alcohol, because experiment has proved to me that it is that which best dissolves the soluble parts of the squill, I only adopt the proportion of 5 parts, which, as we see, produces the greatest quantity of extract.

22. BLACK HELLEBORE.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°	total extr.	3·22
,,	75	,,	5	,,	id.	,,	3·20
,,	75	,,	5	,,	56	,,	4·34
,,	90	,,	6	,,	id.	,,	4·37
,,	75	,,	5	,,	45	,,	2·92

We generally attribute the medical properties of this root to a compound consisting of a volatile acid and a fat substance; on which account alcohol at 80° has been employed for the preparation of this tincture. But if we consider that, according to my experiments, alcohol at 45°, which is the most capable of dissolving the gummy and extractive matters, nevertheless takes up much less of the soluble parts of this root than alcohol at 56°, the conclusion will be, in my opinion, that the last ought to be preferred, for it dissolves a larger quantity than alcohol at 80°. I should even say that alcohol at 56°, as it more readily dissolves the extractive matters, ought to render the solution of the fat substances more easy, because by the disintegration of the extractive matters, it will find itself in close contact with the first. Probably, also, these extractive matters once dissolved, may assist in the solution of the others. Do we not every day see this effect produced, when we treat with water substances containing a mixture of these different substances? The water extract of guaiacum, for example, contains resin, which certainly has been removed by the extractive principle.

I, therefore, give the preference to alcohol at 56° and the proportion of five parts, for it is evident we may neglect the small excess of matter dissolved by one more part of this solvent.

23. ROOTS OF AZARUM.

							grs.
1 pt.	15 gr.	by	60 gr.	or 4 pts.	alco. at 80°	total extr.	1·90
,,	75	,,	5	,,	id.	,,	1·00
,,	60	,,	4	,,	56	,,	3·34
,,	75	,,	5	,,	id.	,,	3·29
,,	90	,,	6	,,	id.	,,	3·30
,,	75	,,	5	,,	45	,,	3·09

I should adopt alcohol at 56° for this tincture, because at that strength it takes up more of the soluble matters, and the root contains rather more of the fatty principle than the leaves. I also recommend the proportion of five parts of this vehicle, although only four parts would be sufficient, as we see by the table. What makes me prefer this proportion, is the fact that this tincture is but little employed, and more particularly to avoid the inconvenience of multiplying these different proportions of alcohol.

grs.
extr. 1·15
,, 1·31
,, 2·29
,, 2·22
,, 1·57

I select alcohol at 56°, and of five parts, which is that most of the substance.

grs.
tal extr. 4·88
,, 5·06
,, 6·27
,, 6·36
,, 6·09

ntained in this root, are cer- l by this last vehicle, and coming in contact with the and as we may also reject the of matter dissolved by six l, I choose the proportion of s solvent.

grs.
tal extr. 1·24
,, 1·82
,, 1·64
,, 1·20
,, 2·13
,, 2·20
,, 2·18

ng peculiarities. It occurred practice of my partner, Mr. myself; we watched it closely t, from peculiar circumstances render the Patient all the as- ished :—

ARY OF THE CASE.

n attenuated epileptic patient uid containing a scruple of ercury in solution. Vomiting minutes afterwards, and diar- which continued during an h-pump used, and albumen

rrhœa continued; vomiting rallied from the shock.
hœa ceased; suppression of alism came on.
m and suppression continued, hœa, disentery, and tenesmus prostration and violent pain; e gums, lips, and tongue.
d; tenesmus continued; febrile on in the evening.

7th.—Excitement of the vascular system continued.

8th.—Excitement passed off; coma came on; convulsions followed. Jactation and trembling ensued.

9th.—Coma increased; convulsions more frequent; prostration; congestion of the lungs; respiration became embarrassed.

10th.—Death occurred early.

Autopsy.—Œsophagus healthy; stomach inflamed; mucous membrane injected and atteniately softened; some blood effused; vascularity of small intestines; cæcal extremity of ileum almost gangrenous; cæcum most highly inflamed, gangrenous, and sloughing; sigmoid flexure of colon and rectum also ulcerated, sloughing, and much inflamed; lungs, congested, lobular pneumonia of the left.—*Lancet.*

AN ANALYSIS OF THE MANNAS OF COMMERCE.*

BY M. LEUCHTWEISS.

The author has examined the varieties of manna most frequently met with in commerce, 1st, the manna canellata—flaked manna; 2nd, manna canellata—manna in lumps; 3rd, manna calabrina—capacy manna.

The following are the substances he met with, and the relative proportions of each of them:—

MANNITE.

To obtain this substance, he destroyed the sugar the mannas contained by means of fermentation, he evaporated the mass until it was dry; the residue, when treated with alcohol, yielded the mannite, which in manna in tears, amounted to as much as 42·6 per cent., while in the capacy manna it was no more than 32 per cent.

SUGARS.

The author thinks it is grape sugar, and he calculated the quantity the mannas contained, by the volume of carbonic acid produced by fermentation; the quantity of sugar varied from 9 to 15 per cent.

M. Leuchtweiss also ascertained the presence of a mucilaginous substance, a small quantity of resin, and an organic acid, altogether amounting to from 40 to 42 per cent.

These mannas contained from 11 to 13 per cent. of water, a considerable proportion as we see. Lastly, by adding together the ashes obtained by the calcination of the insoluble matters, a total of from 1·5 to five per cent. was obtained.

The following is a table of the comparative analysis of three varieties of manna:—

	I. Manna Canellata in flakes.	II. Manna Canellata in the lump.	III. Manna Calabrina.
Water.....	11·6	13·0	11·1
Insoluble matter..	0·4	0·9	3·2
Sugar.....	9·1	10·3	15·0
Mannite....	42·6	37·6	32·0
Mucilaginous matter, resin, organic acid, azotised substances	40·0	40·8	42·1
Ashes.....	1·3	1·9	1·6

We see by this table that the manna canellata is the purest and richest in mannite, after that follows the manna canellata in lumps, and, lastly, the manna calabrina.

* *Journal de Pharmacie.*

FORMULA OF THE OINTMENT USED AS A REMEDY AGAINST ECZEMA.*

BY DEVERGIE.

The following is the composition of an ointment which has been recognised, with justice, by all practitioners as particularly useful in quieting the violent itching sensation in eczema.

R—Lard..... 30 grammes.

Calomel, from 2 to 4 grammes.

Camphor, from 25 to 50 centigrammes.

The camphor must be dissolved in a few drops of alcohol, before it is mixed with the lard.

After the eczema has reached its last stage, the object is to restore the skin to its natural color, to give it its former firmness, to restore its tone as it were. For this purpose various kinds of ointment may be employed, in one of these tannin is introduced.

R—Lard..... 30 grammes.

Tannin..... 4 grammes.

Oil or tar may be employed, but in that case ointments of a fourth or fifth of their weight of lard must not be prescribed, but a smaller proportion after the following formula:—

R—Lard 50 grammes.

Tar, from 5 decigrammes to 1 gramme.

The tar has great resolving power, but it it is also extremely exciting to an eczematore surface.

* *Journal de Pharmacie.*

ON THE ACTION OF BITTER ALMONDS, THE LEAVES OF THE CHERRY-LAUREL, PEACH BLOSSOMS, AND THEIR DISTILLED WATERS. ON ESSENTIAL OILS, AND AROMATIC SUBSTANCES IN GENERAL.*

BY M. MAHER.

THE notice already taken of the disappearance of the smell of musk in syrup of orgeat, as established by M. Soubeiran, and recognised afterwards in the case of cherry-laurel water, by M. Fauve, of Bordeaux, led me to generalise this action upon essential oils, and all strongly scented substances.

Without being able to add to the stores of science anything as to the cause, the experiments I am about to mention may be of interest, if it were only to point out a quick and easy method of cleansing and rendering fit for any use, bottles, or vessels of any kind, which can, in many cases only be used for the substances by which they were infected.

Very lately I wished to avoid the trouble of the sweetening, always imperfect and disagreeable, of a marble mortar I had used for the preparation of an assafœtida lotion, by means of vinegar, and afterwards of ashes. I though of trying the residuum of some almond paste, which I had just employed in the preparation of orgeat; and having taken a portion and rubbed my mortar with it, as the smell still remained, I added a little water, when a strong odour of bitter almonds was perceptible; I rubbed it again, washed it with a quantity of water and the smell had completely disappeared.

This first attempt induced me a few days afterwards, to apply the same plan to phials and bottles which had held camphorated eau-de-vie, oil of spike, essence of cloves, peppermint, orange, lavender, lemon, and turpentine, and the oils of petrolium, copahu, cod's liver, creosote, and a number of odoriferous, balsamic, and resinous substances.

All these bottles were cleansed, without smell, and as if new.

But it was necessary, in the first instance, to remove the grease from those which were oily, by means of pearlash or potash, and to rinse those which contained resinous and balsamic tinctures, with alcohol, before you used the almond paste. It is clear that pure bitter almond paste, without sweet almonds, would succeed better when used in the same quantity; but the article usually sold will not succeed so well, as much, frequently, on account of its age as of its having been adulterated with bran, flour, &c.; but fresh cakes of bitter almonds may easily be procured and pulverised for the purpose.

The leaves of the cherry-laurel, and of the peach, if bruised, and reduced to a pulp, and introduced into the bottles, act in the same manner. A handful of these leaves, rubbed upon the sides of a mortar, or any other scented vessel, have, using a little water, succeeded with me as well as bitter almonds.

The distilled waters of bitter almonds, cherry-laurel, and peach, especially if they are recent, have the same effect if the same precautions are used, but it is more expensive to employ them.

It must be the same in the case of all seeds, flowers, or leaves, that contain hydrocyanic acid, even with other odoriferous substances that have not as yet been experimented on. This explains the common practice of applying laurel leaves to new jars and other vessels, either by placing them in an oven, or boiling them in water.

After these trials I think I may assert that the paste of bitter almonds, or a pulp of the flowers of the laurel or the peach, may become applicable to the preservation of fish and meat during their transport, and act as a condiment to them; that their distilled waters may improve the smell in dissecting amphitheatres, newly painted apartments, and rooms in hospitals. I am above all convinced of their success in removing the musty smell from vessels, and even barrels, by giving them some time to act, and frequently agitating them on account of the porous nature of the wood.

It remains now to be ascertained whether the action of hydrocyanic acid can or cannot modify the medical properties of odorous substances; it is the business of medical men to ascertain whether they ought not to suppress cherry-laurel water and syrups of orgeat, in draughts, containing distilled waters or aromatic substances.

* *Journal de Chimie.*

ON THE PROPERTIES OF THE LEAVES OF THE OXALIS CRASSICAULIS, AND THEIR USE AS AN ASTRINGENT, PARTICULARLY IN HEMORRHAGE AND CHRONIC CATARRH.*

THE oxalis is a plant originally brought from Peru; but it has for some time been employed in Europe. Dr. Montain has drawn attention to this plant in the last number of the *Journal de Médecine*, of Lyons. There

* *Journal de Pharmacie.*

are several varieties; but the oxalis crassicaulis is that which possesses the most decided effect. Its tubers, which are very abundant, afford an agreeable and nourishing article of food. Its stems and leaves are numerous and succulent, fit to eat, and cultivated in Peru for that purpose. But their most remarkable property is their therapeutic action; they furnish the materia medica with an extremely astringent juice, which has often succeeded with M. Montain, when other agents of the same nature have failed.

The juice of the leaves is of a powerful, but agreeable, acid, it is very abundant, and can be preserved without spoiling. The following is the method by which it is obtained:—a little before the frost sets in, the stems of the oxalis are collected, they are submitted to strong pressure, and a quantity of juice is extracted, calculated at three-fourths of the weight of the stalks and leaves employed. After this, by macerating what remains in a certain quantity of water, you may still obtain a liquid sufficiently acid to be used as a weak astringent.

The juice readily mixes with sugar, and forms an acid syrup, of a slightly aromatic flavour. M. Montain prescribes this juice, either pure or sweetened, or in different proportions, when mixed with some other substance. He has specially used it inwardly in doses of from 3 to 6 spoonfuls a day; he has sometimes prescribed it in lavements or injections.

The diseases that appear to have been chiefly affected by the action of this medicament, are the following:—Hemorrhage of the womb, either passive or chronic, and most fluxes of the same nature, not always connected with organic disease. A continuance of the medicine from five to fifteen days has often been sufficient to stop or to reduce hemorrhages of this nature, that have existed for months and even years. Fluxes of blood from the rectum, and two cases of ruptured blood vessels have been cured by this means; chronic catarrhs, diarrhœa and disentery, in particular, have been treated with advantage by the juice of the oxalis, either pure or taken in geneva. It has even been given in old cases of gonorrhœa, particularly those which have resisted the action of copaiba.

The oxalis belongs to the natural family of the Geranidæ, and must not be confounded with the rumex acetosa of the family of the Poligoneæ. M. de Candolle has formed them into a new group under the name Oxalidæ. The oxalis crassicaulis produces large stems, which are cut in November, for the purpose of expressing the juice; the tubers are then left for three or four months to increase and hardeah one of these, alone, is sufficient to produce several hundreds, and a plot of ground three metres square, is sufficient to furnish as much as 80 litres of pure juice.

BOLOGNA CATECHU, PARTIGLIE DI TERRA CATECU AROMATICA OF THE ITALIANS.*

BY M. DORVAULT.

The following formula for this preparation is of Italian origin:—

Extract of liquorice by infusion	*aa* 10 grammes.
Water	

Place it in a sand-bath, and add,

Bengal catechu, in powder	30 grammes.
Gum, in powder	15 grammes.

Evaporate it to the consistence of an extract, and then incorporate the following powders, which must be exceedingly fine:—

Mastic	*aa* 2 grammes.
Cascarilla	
Charcoal	
Florence iris	

Let the mass become of a proper consistence, remove it from the fire, and add,

English essence of peppermint	2 grammes.
Tincture of amber	*aa* 5 drops.
Tincture of musk	

Pour it on to a slab of marble, previously greased, and roll it out by means of a rolling pin to the thickness of a half-franc piece. When the mass is cold, rub it with a piece of blotting-paper, to remove the oil completely from both surfaces; then slightly moisten both sides, and spread silver leaf over them; allow it to dry; cut the sheet into narrow strips, afterwards cut the strips into very small squares or lozenges (about the size of the seeds of fanugrec).

The catechu that is brought from Italy is contained in small oval deal boxes, weighing about 20 grammes, and covered with a large seal of red sealing-wax.

We do not give this receipt as the true one—the latter appears to be the secret of one or two Bolognese pharmacopolists—but merely as a formula producing an article that will in every respect answer the purpose of the Italian preparation.

The Bologna catechu is a pleasantly-tasted preparation; it is as frequently taken as a sweetmeat, as a medicine, and we must attribute to it the tonic and carminative pro-

* *Journal de Pharmacie.*

parties of the substances of which it is composed.

Two or three pastilles, or grains, are sufficient to give the breath the most agreeable perfume and freshness.

The Bologna catechu corrects the bad breath caused by affections of the stomach, decayed teeth, &c.; and smokers frequently use it to conceal the smell of tobacco. In most parts of Italy the richer classes always carry it about with them, and take it as a pastime.

TREATMENT OF EPILEPSY BY DIGITALIS.*

BY P. J. CORRIGAN, M.D.

FOXGLOVE has been, from time immemorial, a quack remedy, in the rural districts of Ireland, for epilepsy. Its effects, as administered by the women who profess to cure the disease, have been so violent, that the profession has shrunk from its administration, although success had in many instances followed on its exhibition. The following is the formula which is generally used:—Fresh leaves of digitalis, four ounces; beat into a pulp, and pour over it a pint of boiling beer; infuse for eight hours, and strain with expression. Of this give, every third day, four ounces, with fifteen grains of dried root of polypodium. In another formula the dose is to be repeated every third hour until vomiting is produced. In 1828, Sir P. Crampton informed Dr. Corrigan that he had superintended its exhibition in four cases, and that in three of these it had been successful, but that he did not venture beyond the first dose, its effects were so violent. It caused violent and continuous vomiting like that of seasickness, which continued incessantly for 24 hours, with irregularity and feebleness of pulse that remained for several weeks after. In the year 1831, Dr. Sharkey, of Cork, in a paper in the *Lancet*, drew the attention of the profession to its good effects in the disease, given according to a similar formula. The effects of a single dose (four ounces) were vomiting, soreness of epigastrium, cold extremities, cramps, and great depression and irregularity of pulse, continuing for several days. The author gave the remedy himself in the same form, and is not surprised that the profession should shrink from employing it. The first dose produced the most violent vomiting, followed by cold sweats, feeble and irregular pulse, and these symptoms again by intense gastritis, accompanied with great sinking of the vital powers, and double vision, which continued for several days, sufficient to deter him from ever again venturing upon its administration in such a dose.

There are some circumstances connected with the effects of this large dose that may be worth noticing here; it was given at ten o'clock, A.M.: at twelve o'clock the pulse had fallen thirty beats, viz., from eighty-six to fifty-six, and there was slight headache, with very slight nausea: it was not until eight o'clock, P.M., ten hours after the administration of the dose, that the violent symptoms set in. It then occurred to Dr. C. that as it is a remedy possessing a cumulative property, he might succeed in saturating, as it were, the nervous system with its sedative influence, without the risk of inducing those frightful effects which follow on the sudden exhibition of the large dose; and he believes that he can now venture to say that this important point in practical medicine can be gained. After many trials of its preparations, he gives the preference to the infusum digitalis of the Dublin Pharmacopœia, but he cannot too strongly insist on the necessity of the greatest attention being paid to see that the leaves are well prepared, and of the latest gathering. The mode of administration is to begin with ʒj. of the infusion every night at bed-time, increasing it after a week to ʒiss., and after another week to ʒij., beyond which it is rarely necessary to go, and continuing it until sickness of the stomach and dilated pupils are observed, when the dose is to be diminished by ʒss. or ʒj. until the maximum dose that can be borne without inconvenience is ascertained, at which the administration is to be continued for two or three months. Given in this way, its exhibition is attended with no inconvenience beyond an occasional attack of slight sickness of stomach in the morning, or headache, &c., when the medicine is to be omitted, and a day or two are to be allowed to pass over before resuming its use. With the exception of these symptoms, there is no perceptible effect, beyond slow action of the heart, and the patient during its use is able to follow his ordinary avocations. Two cases are related, but as the paper is to be continued, Dr. Corrigan will probably lay others before the profession. The first is that of a gentleman, æt. 27, who during the previous seven months had suffered from repeated attacks of epilepsy, followed by delirium. He was kept under the influence of the medicine for about five months, when the attacks having gradually become milder and milder, at length ceased altogether. The patient has remained without a return of the disease for four years. In the second case the effects were only watched for about six weeks, but even in this time the attacks had ceased.

* *Dublin Hospital Gazette.*

are several varieties; but the oxalis crassicaulis is that which possesses the most decided effect. Its tubers, which are very abundant, afford an agreeable and nourishing article of food. Its stems and leaves are numerous and succulent, fit to eat, and cultivated in Peru for that purpose. But their most remarkable property is their therapeutic action; they furnish the materia medica with an extremely astringent juice, which has often succeeded with M. Montain, when other agents of the same nature have failed.

The juice of the leaves is of a powerful, but agreeable, acid, it is very abundant, and can be preserved without spoiling. The following is the method by which it is obtained:—a little before the frost sets in, the stems of the oxalis are collected, they are submitted to strong pressure, and a quantity of juice is extracted, calculated at three-fourths of the weight of the stalks and leaves employed. After this, by macerating what remains in a certain quantity of water, you may still obtain a liquid sufficiently acid to be used as a weak astringent.

The juice readily mixes with sugar, and forms an acid syrup, of a slightly aromatic flavour. M. Montain prescribes this juice, either pure or sweetened, or in different proportions, when mixed with some other substance. He has specially used it inwardly in doses of from 3 to 6 spoonfuls a day; he has sometimes prescribed it in lavements or injections.

The diseases that appear to have been chiefly affected by the action of this medicament, are the following:—Hemorrhage of the womb, either passive or chronic, and most fluxes of the same nature, not always connected with organic disease. A continuance of the medicine from five to fifteen days has often been sufficient to stop or to reduce hemorrhages of this nature, that have existed for months and even years. Fluxes of blood from the rectum, and two cases of ruptured blood vessels have been cured by this means; chronic catarrhs, diarrhœa and dysentery, in particular, have been treated with advantage by the juice of the oxalis, either pure or taken in geneva. It has even been given in old cases of gonorrhœa, particularly those which have resisted the action of copaiba.

The oxalis belongs to the natural family of the Geranideæ, and must not be confounded with the rumex acetosa of the family of the Poligoneæ. M. de Candolle has formed them into a new group under the name Oxalideæ. The oxalis crassicaulis produces large stems, which are cut in November, for the purpose of expressing the juice; the tubers are then left for three or four months to increase and harden. A crop of these, alone, is sufficient to produce several hundreds, and a plot of ground three metres square, is sufficient to furnish as much as 80 litres of pure juice.

BOLOGNA CATECHU, PARTIGLIE DI TERRA CATECU AROMATICA OF THE ITALIANS.*

BY M. DORVAULT.

The following formula for this preparation is of Italian origin:—

Extract of liquorice by infusion	*aa* 10 grammes.
Water	

Place it in a sand-bath, and add,

Bengal catechu, in powder	30 grammes.
Gum, in powder	15 grammes.

Evaporate it to the consistence of an extract, and then incorporate the following powders, which must be exceedingly fine:—

Mastic	*aa* 2 grammes.
Cascarilla	
Charcoal	
Florence iris	

Let the mass become of a proper consistence, remove it from the fire, and add,

English essence of peppermint	2 grammes.
Tincture of amber . ..	*aa* 5 drops.
Tincture of musk	

Pour it on to a slab of marble, previously greased, and roll it out by means of a rolling pin to the thickness of a half-franc piece. When the mass is cold, rub it with a piece of blotting-paper, to remove the oil completely from both surfaces; then slightly moisten both sides, and spread silver leaf over them; allow it to dry; cut the sheet into narrow strips, afterwards cut the strips into very small squares or lozenges (about the size of the seeds of fanugrec).

The catechu that is brought from Italy is contained in small oval deal boxes, weighing about 20 grammes, and covered with a large seal of red sealing-wax.

We do not give this receipt as the true one—the latter appears to be the secret of one or two Bolognese pharmacopolists—but merely as a formula producing an article that will in every respect answer the purpose of the Italian preparation.

The Bologna catechu is a pleasantly-tasted preparation; it is as frequently taken as a sweetmeat, as a medicine, and we must attribute to it the tonic and carminative pro-

* *Journal de Pharmacie.*

pastiles of the substances of which it is composed.

Two or three pastilles, or grains, are sufficient to give the breath the most agreeable perfume and freshness.

The Bologna catechu corrects the bad breath caused by affections of the stomach, decayed teeth, &c.; and smokers frequently use it to conceal the smell of tobacco. In most parts of Italy the richer classes always carry it about with them, and take it as a pastime.

TREATMENT OF EPILEPSY BY DIGITALIS.*

BY P. J. CORRIGAN, M.D.

FOXGLOVE has been, from time immemorial, a quack remedy, in the rural districts of Ireland, for epilepsy. Its effects, as administered by the women who profess to cure the disease, have been so violent, that the profession has shrunk from its administration, although success had in many instances followed on its exhibition. The following is the formula which is generally used:—Fresh leaves of digitalis, four ounces; beat into a pulp, and pour over it a pint of boiling beer; infuse for eight hours, and strain with expression. Of this give, every third day, four ounces, with fifteen grains of dried soot of polypodium. In another formula the dose is to be repeated every third hour until vomiting is produced. In 1828, Sir P. Crampton informed Dr. Corrigan that he had superintended its exhibition in four cases, and that in three of these it had been successful, but that he did not venture beyond the first dose, its effects were so violent. It caused violent and continuous vomiting like that of seasickness, which continued incessantly for 24 hours, with irregularity and feebleness of pulse that remained for several weeks after. In the year 1831, Dr. Sharkey, of Cork, in a paper in the *Lancet*, drew the attention of the profession to its good effects in the disease, given according to a similar formula. The effects of a single dose (four ounces) were vomiting, soreness of epigastrium, cold extremities, cramps, and great depression and irregularity of pulse, continuing for several days. The author gave the remedy himself in the same form, and is not surprised that the profession should shrink from employing it. The first dose produced the most violent vomiting, followed by cold sweats, feeble and irregular pulse, and these symptoms again by intense gastritis, accompanied with great sinking of the vital powers, and double vision, which continued for several days, sufficient to deter him from ever again venturing upon its administration in such a dose.

There are some circumstances connected with the effects of this large dose that may be worth noticing here; it was given at ten o'clock, A.M.: at twelve o'clock the pulse had fallen thirty beats, viz., from eighty-six to fifty-six, and there was slight headache, with very slight nausea: it was not until eight o'clock, P.M., ten hours after the administration of the dose, that the violent symptoms set in. It then occurred to Dr. C. that as it is a remedy possessing a cumulative property, he might succeed in saturating, as it were, the nervous system with its sedative influence, without the risk of inducing those frightful effects which follow on the sudden exhibition of the large dose; and he believes that he can now venture to say that this important point in practical medicine can be gained. After many trials of its preparations, he gives the preference to the infusum digitalis of the Dublin Pharmacopœia, but he cannot too strongly insist on the necessity of the greatest attention being paid to see that the leaves are well prepared, and of the latest gathering. The mode of administration is to begin with ʒj. of the infusion every night at bed-time, increasing it after a week to ʒiss., and after another week to ʒij., beyond which it is rarely necessary to go, and continuing it until sickness of the stomach and dilated pupils are observed, when the dose is to be diminished by ʒss. or ʒj. until the maximum dose that can be borne without inconvenience is ascertained, at which the administration is to be continued for two or three months. Given in this way, its exhibition is attended with no inconvenience beyond an occasional attack of slight sickness of stomach in the morning, or headache, &c., when the medicine is to be omitted, and a day or two are to be allowed to pass over before resuming its use. With the exception of these symptoms, there is no perceptible effect, beyond slow action of the heart, and the patient during its use is able to follow his ordinary avocations. Two cases are related, but as the paper is to be continued, Dr. Corrigan will probably lay others before the profession. The first is that of a gentleman, æt. 27, who during the previous seven months had suffered from repeated attacks of epilepsy, followed by delirium. He was kept under the influence of the medicine for about five months, when the attacks having gradually become milder and milder, at length ceased altogether. The patient has remained without a return of the disease for four years. In the second case the effects were only watched for about six weeks, but even in this time the attacks had ceased.

*. *Dublin Hospital Gazette.*

CHLORINE IN SCARLATINA.*

BY CHARLES MAITLAND, M.D.

The administration of chlorine in scarlatina, recently recommended by various practical writers, is attended with a theoretical difficulty which is likely to prevent many from fully testing its power of disinfecting the poisoned secretions. I refer to its liability to produce corrosive sublimate, by combination with calomel previously introduced into the system. My object in troubling you with this paper is twofold:—to draw the attention of your readers to the remedy, and its mode of exhibition; and also to obtain from those who have tried it, such assurance of its safety, or description of the cautions necessary, as may embolden others to employ it.

The formula for preparing chlorine in solution is given in Dr. Watson's "Lectures on the Practice of Physic," vol. ii., p. 764, second edition. A drachm of chlorate of potash is there ordered to be dissolved in an ounce of hydrochloric acid, previously diluted with an ounce of water. This proportion of water is too small, being neither sufficient to dissolve the chlorate nor to retain the gaseous chlorine in solution at the ordinary temperature of a chemist's shop. I should therefore recommend two ounces of water to insure uniformity, and this in addition to the usual precaution of a well-stoppered bottle, and a dark place for its preservation.

That such a solution of chlorine, even when highly diluted, will convert calomel into corrosive sublimate is easily proved. After some preliminary experiments, made to determine the general fact, I mixed together six minims of Dr. Watson's solution of chlorine, two ounces of water at 60°F., and two grains of calomel. After ten minutes, a drop of the fluid placed upon polished gold, and touched with a steel point, yielded a perceptible amalgam; and after fifteen minutes a decided amalgam was formed. After thirty minutes, iodide of potassium gave a pale scarlet precipitate.

A similar mixture at the temperature of 98°F. yielded traces of mercury by the amalgam test, after five minutes' digestion.

Two ounces of warm infusion of tea, with some tea-leaves, milk, and sugar, were mixed with six minims of solution of chlorine, and two grains of calomel. After an hour, all smell of chlorine had disappeared, and no trace of amalgam could be obtained during the next sixteen hours.

From these experiments, it would seem that the formation of corrosive sublimate by the co-administration of chlorine and calomel, depends upon the amount of organic matter present in the stomach and bowels; a condition which materially affects also the disinfecting power of chlorine, if we may judge of the processes within the body by that which takes place without it. Experience, therefore, must decide the question, whether chlorine can be both safely and effectively given to persons already influenced by mercury, or taking it at the time.

After fasting for five hours, I took at bedtime two grains of calomel, and immediately after three ounces of water, containing six minims of the solution of chlorine. A dull pain and heat over the umbilical region during the night, with the griping usually attributed to the action of mineral acids together with mercury, were the only unpleasant symptoms that followed; but next day there were slight coppery taste, looseness of the teeth, and a little gray edging to the gums, never before produced by the same dose of calomel alone. There is, therefore, reason to suppose, that if followed up by repeated doses of solution of chlorine, the *Draco mitigatus* would have altogether forfeited its claim to the appellation, and under some circumstances disagreeable results might occasionally follow.

Should this paper meet the eye of Dr. Watson, it is hoped that he will be kind enough to supply any information which he may possess on this point, and thereby add to the obligations which he has already conferred on the profession, by the many valuable suggestions contained in his truly practical work.

* *Lancet*, Jan. 10, 1846.

THE MEANS OF ASCERTAINING THE EFFICACY OF DIGITALIS.

BY M. FALKEN.

According to M. Falken, the following plan is a means of ascertaining, in an infallible manner, whether or not digitalis possesses its virtues.

50 centigrammes of the powder of the leaves of digitalis are to be infused in boiling water, and after an hour to be strained off. When cold 20 to 30 drops of a solution of ferrocyanide of potash are added, prepared with 75 centigrammes of this salt, to 15 grammes of distilled water.

If the digitalis is active, the infusion becomes rather clouded, but if this cloud does not appear before ten or fifteen minutes, we may consider the digitalis as not possessing a sufficient degree of activity.

According to M. Falken, the digitalis grown in Switzerland has proved the most active.

ADULTERATION OF DRUGS.

1. State of Mercury in the compound Pills of Chloride of Mercury.
2. Oxysulphuret of Antimony, an Antidote for the Bichloride and Chloride of Mercury.
3. Adulteration of the Oxysulphuret of Antimony.

To the Editors of The Chemist.

GENTLEMEN,—For some time past I have had repeated opportunities of comparing the action of one grain of chloride of mercury with that of the compound pills of chloride of mercury of the London Pharmacopœia in the dose of five grains, which is said to contain rather more than one grain of the chloride. The former acted as an active purgative, but the latter produced little or no action on the bowels when taken by the same individual.

I knew a gentleman who took a five-grain pill of the compound every night for more than a year, also a lady who took one, and sometimes two, daily, for nine months without any perceptible effect.

From these observations I was induced to examine the compound, which I found, when in a moist state, to contain an uncombined acid. By treating the mass with water, chlorine was held in solution, owing to the decomposition of the chloride of mercury by the oxysulphuret of antimony. The sulphur unites with the mercury, forming almost an inactive compound, and the free chloride remains in solution, owing to the chloride of antimony being insoluble in water. Sulphur has a greater affinity for antimony than it has for mercury; but the chloride having a greater affinity for antimony than it has for mercury, the decomposition of the calomel is effected.

I would beg to suggest the propriety of omitting the chloride of mercury in the compound pills, and substituting sulphuret of mercury, which would enable the practitioner to see more clearly the nature of the remedy which he prescribes, without being misled by the decomposition which takes place. I consider the pills are not entitled to the name "pilulæ hydrargyri *chloridi* compositæ," because the mercury is no longer a chloride when the pills are in a moist state or dissolved in the stomach.

The result of these experiments induced me to try the action of oxysulphuret of antimony on the bichloride of mercury, when I found about five parts of the former capable of decomposing one part of the latter, simply by triturating the mixture in a mortar with distilled water for a few minutes. The filtered liquid being tested, free chlorine was held in solution, but no trace of the bichloride of mercury could be detected, even when the sediment was treated with hydrochloric acid.

I am not aware that the oxysulphuret of antimony has ever before been introduced as an antidote for the bichloride of mercury; but I am of opinion that it will be found equal if not more efficacious than albumen, owing to the absorbent property of the oxysulphuret in small doses, and acting as an emetic in large doses would cause the poison to be rejected as well as decomposed. The oxysulphuret should be given in water in the above proportions, according to the quantity of the poison taken as near as can be ascertained, and afterwards administered in small doses. It must be observed that the antidote is incapable of decomposing any other preparation of mercury, except the bichloride and the chloride.

The above experiments led me to a third investigation. I found the liquid containing chlorine yielded, by evaporation, a quantity of small white insoluble crystals, which I found upon examination were composed of sulphate of lime. How sulphate of lime could possibly exist in the oxysulphuret of antimony was scarcely credible, no lime being used in preparing it. But chemistry is able to solve many mysteries which the eye, taste, and smell are unable to detect. I regret, therefore, to be under the necessity of bringing before the public another disgraceful system of adulteration practised by some of the manufacturing chemists. The base practice carried on by some of these persons, is not only a degradation to themselves and to our nation, but I consider they are guilty of hurrying many individuals to an early grave. It is impossible for the practitioner to prescribe for his patient with any degree of certainty, the effect of course must be directly opposite to that which he expects.

I have proved by experiment that the oxysulphuret is not simply mixed with the sulphate of lime, but a malicious cunning system is adopted in the laboratory in order to avoid detection. The antimony is ordered in the Pharmacopœia to be boiled with a solution of potash, instead of which *lime* is substituted, and sulphuric acid being added, the oxysulphuret of antimony is precipitated in combination with about 30 per cent. of sulphate of lime (gypsum), amounting to [illegible]

In the old Pharmacopœia the pilulæ hydrargyri chloridi compositæ was ordered to be made into a mass with rectified spirit, which sometimes prevented the pills from dissolving in the stomach; this, I believe, may

be owing to the sulphate of lime in the antimony uniting with the guaiacum forming a hard cement, and not caused entirely by the guaiacum being insoluble.

The precipitated sulphur of commerce known to every family under the name of milk of sulphur, and which is frequently given to delicate children, has also been lately discovered to be adulterated with sulphate of lime, a substance well known to possess highly deleterious properties, by constipating the bowels and arresting the process of digestion, thereby laying the foundation of disease. The precipitated sulphur is prepared in a similar manner to the oxysulphate of antimony: the sulphur is ordered to be boiled with lime, but instead of adding muriatic acid to throw down the sulphur and hold the lime in solution, they use *sulphuric acid*, which precipitates the sulphur in combination with about 50 per cent. of sulphate of lime, which forms a beautiful preparation as far as the eye can detect, even surpassing the genuine.

I do not wish to accuse all the manufacturers of these preparations of committing this mercenary fraud; but I regret to add, that I have examined a number of samples from some of the most respectable London houses, all of which were adulterated in the manner described.

I trust the foregoing may be allowed a space in your valuable journal, through the medium of which I hope every kind of adulteration will become generally known and abolished. The public, unfortunately, are not aware, when they endeavour to procure cheap drugs, that they are giving every encouragement to the practice of adulteration; and if they are not endangering their own lives by so doing, they prevent a more speedy restoration to health when the aid of medicine is required.

I am, gentleman,
Your most obedient servant,
Southampton, Hy. Osborne.
Dec. 30, 1845.

SUICIDE BY POISONING WITH THE ESSENTIAL OIL OF BITTER ALMONDS.*

The following facts were elicited at an inquest held before Mr. Wakley, at the House of Correction, Coldbath Fields, in December:—

T. K———, aged 19 years, black hair and ruddy complexion, a journeyman baker, was sentenced, on Saturday, Dec. 6, to undergo 14 days' imprisonment. He was placed in the cell of the Marylebone Police Court, and at 20 minutes before six o'clock p.m., he was put into the prison van, to be conveyed to the House of Correction, at which place he arrived at a quarter after seven o'clock. He was in perfect health when he entered the van. On leaving the van at the prison, he attracted the notice of the gate-keeper, who called to him by his name, when he answered feebly, "That's me—that's me." With slight assistance he walked to the room where the prisoners are searched, when a half-ounce bottle was found upon him, labelled "Essential oil of almonds." Suspicion then arose that he had taken poison, and Mr. Wakefield, surgeon to the prison, and Mr. Smiles, his assistant, were immediately in attendance upon the prisoner. He stood in an erect posture in the room for about five minutes. There was nothing very striking or peculiar in his appearance. No smell of poison at his mouth; the pupils much dilated; pulse rapid and feeble; skin pallid. The stomach-pump was used, and the smell of essential oil of almonds could be detected in the extracted liquid. Ammonia was freely administered, and warmth applied to his extremities; but he expired at a quarter before nine o'clock, just three hours after he entered the van in perfect health.

The post-mortem examination was made by Mr. Wakefield 40 hours after death, and he stated in his evidence that the blood was fluid in all parts of the body. On taking off the calvarium, a considerable quantity of fluid blood escaped, and the dura mater and substance of the brain were found gorged with blood. There was no serum in the ventricles. The pericardium contained an ounce or two of serum. Both ventricles of the heart contained fluid blood; both lungs were gorged with blood, and there was a small quantity of serum in the cavities of the pleuræ. The intestines had a bloodless appearance. On taking out the stomach, the contents had a strong smell of almonds, and the inner coat towards the pyloric orifice had a red appearance. All the other organs were healthy. The body was observed to have a strong smell of almonds before opening the stomach. There were livid spots on the skin of the face and neck, and on the upper parts of the thighs and legs.

The essential oil was purchased at the shop of a surgeon and chemist in Upper Ebury-street, Pimlico. It was *not* labelled "poison." The quantity was two drachms. The young man was a person of sober habits, and had never exhibited any signs of mental derangement.

* *Lancet.*

BOOKS, &c.

r the year contains some
ulars of the more eminent
-viz., Dr. Heberden, Pro-
Dr. James Johnson, Dr.
thew Tierney, Mr. Everitt,

CATALOGUE OF APPARATUS, &c.

by Charles Button. Lon-

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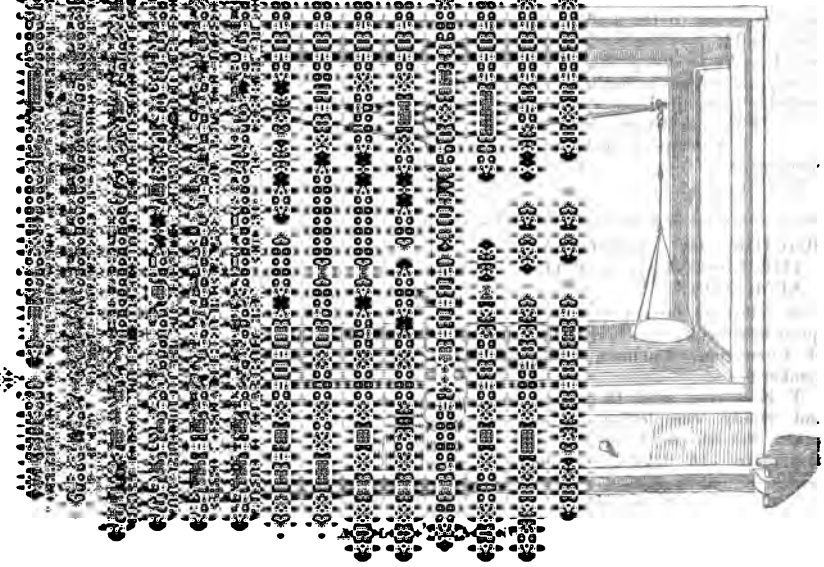
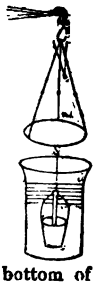


0·001 gramme; but, if carefully handled, will show half of that weight. In putting the weights into the pans care should be taken not to touch them with the fingers; the forceps should always be used. Those with ivory points are most appropriate. The balance must be protected against unequal temperature and currents of air; the sun should not shine upon it: the currents of air will be prevented by keeping the lantern closed.

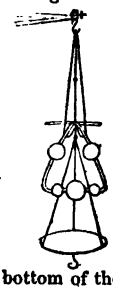
Small changes in weight, from 0·01 of a gramme to 0·001, may be obtained by putting a little weight from the box, in the shape of a saddle, upon the beam; which weight can be moved by means of a rod passing through the lantern on the left side.

Fig. 1.



To obtain a short stringed pan for taking specific gravities, the platina wires are so arranged that the small ring (as in Fig. 1) may be fixed to the steel hook, when it will then have the appearance as shown in the drawing. At the bottom of the pan is a small hook, from which, by means of a fine platina wire, a glass cup or pan may be suspended.

Fig. 2.



For the weighing of Liebig's potash apparatus, a thin brass wire will be found in the drawer, which may be bent to any shape. It is then to be suspended to one of the steel hooks (as in Fig. 2). Two brass weights, to act as counterpoises to the glass pan and brass hoop, will be found with the weights in the drawer.

The left-hand side of the lantern may be enlarged by a frame, which is packed at the bottom of the lantern until required.

For weighing larger objects, such as glass tubes, the column may be turned, when the pans will be outside of the lantern.

THE LONDON SEWAGE COMPANY.

Report upon the various Plans proposed for rendering available the Manure contained in the Sewage water of the Metropolis, &c. By Thos. Wickstead, Esq., Engineer to the Company.

THE anticipated exhaustion of the stock of guano, and the doubt that rests on the reception of fresh supplies from abroad, together with the recent inquiries into the health of large towns, have originated various projects to supply its place, among which, that to which the pamphlet that now lies before us refers, is one. It seems that two companies have started for the purpose of purifying the atmosphere of the metropolis, and preventing the contents of the sewers being poured into the waters of the Thames. Both these companies have the same object in view, but each proposes to carry that object out in a different manner, the "London Sewage Company" intend to collect the contents of the sewers in an intercepting sewer, and convey them by means of the latter to the proposed works of the company, situated in an angle formed by the western banks of Barking Creek and the northern banks of the Thames. There the solid portion of this liquid manure is to be separated and dried, and afterwards used in the same manner as guano. The rival company, "the Metropolitan Sewer Manure Company," have the same object in view; but propose to conduct the contents of the sewers to the spots where they are needed, by means of pipes of large dimensions, having smaller branch pipes, by means of which the fields are to be irrigated. All the details of expense appear to have been fully entered into; but one of the most essential points, the value of the sewage as a manure, has been almost neglected, and no experiments have been made to ascertain that value. It is true we have a table in which the quantity of solid matter, in 13080 parts, is mentioned, but in a very unsatisfactory manner; thus for instance—

Valuable mechanical deposits	8½
Useless.....	4½
Valuable mechanical precipitate..	12½
Lime, as manure	5

The lime was added to precipitate the other substances. The subject, no doubt is deserving of inquiry, and the preliminary steps should consist of accurate chemical analysis of the liquid and solid portions of the sewage, and carefully conducted experiments on different soils.

TO CORRESPONDENTS.

"AMICUS CERTUS."—Consult Gray's Supplement to the Pharmacopœia.

"MR. OSBORNE" will perceive that we have inserted his communication, and we have done so with great pleasure, in order that the attention of professional men may be fixed on the important subject.

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 310, Strand, London." *Communications must be prepaid, and sent before the* 15*th of each month; Books for Review before the* 10*th.*

THE CHEMIST.

I. CHEMISTRY.

OBSERVATIONS ON THE CHEMISTS OF FRANCE.

BY BARON LIEBIG.

Several of the principal chemists in France having, within the last few years, endeavoured to invalidate the chemical researches of Professor Liebig, the latter has at length turned round upon his assailants, and in a recent number of the *Lancet* he has made a furious attack upon two of their members, Messrs. Gerhardt and Laurent; he accuses them of "attempting to establish a kind of dictatorship over the domain of chemistry, and constituting themselves supreme arbiters in all questions belonging to the science." They have been incited to this, he asserts, from the world having neglected their theories and labours, and consequently, "casting up a flag of their own they summoned all chemists to range themselves under it, and, as prophets of a new faith, commanded all to bow before them and swear allegiance, threatening with destruction all who should disregard their decrees or oppose their behests."

These few observations of the German professor, to whom the chemical world is indebted for so many of its known laws, a portion of its knowledge of organic chemistry, plainly shows the extent of provocation to which he had been subjected.

At the same time that the Baron defends himself from the charges of error, he points out various cases of inaccuracy in the works of his assailants; for instance—

In No. 21 of the 19th vol. of the *Comptes Rendus*, M. Gerhardt states, that when brucine is dissolved in nitric acid the nitrite of oxide of ethyle (nitrous æther) is formed. This assertion is flatly contradicted by Baron Liebig.

"I found, indeed," he says, "that brucine, when acted upon by nitric acid at a gentle heat, dissolves, with evolution of a gas, which burns with a greenish-blue flame, and is readily absorbed by hydrochloric and nitric acid. The severity of the season, at the time I made this experiment, enabled me to condense a portion of this gas. Nitrite of oxide of ethyle boils at 61·7, and floats upon water. The fluid which the gaseous product of the brucine formed upon condensation, was not miscible with water, and sank to the bottom when mixed even with dilute nitric acid; it was consequently of greater specific gravity than water; it began to boil at 158—167°. All these properties show, evidently and plainly, that the product of the decomposition of brucine by nitric acid cannot well be confounded with nitrite of oxide of ethyle."

M. Gerhardt had also stated, in the *Comptes Rendus* for 1841, page 262, that he had obtained valerianic acid by the action of potash on indigo. "Indigo is projected in small quantities into hydrate of potash, in a state of fusion; the indigo dissolves in the fused potash, with copious evolution of ammonia and hydrogen gas, and the residue contains carbonate and valerianate of potash."

This experiment, the German chemist shows, has been several times repeated with great care without giving rise to the evolution of ammonia.

"These two discoveries," he observes, "of M. Gerhardt are characteristic of the man! The odour of the product which the brucine yields upon its solution in nitric acid suffices to satisfy M. Gerhardt that he has produced nitrous æther! He deems it altogether unnecessary to subject the new product to the test of a careful analysis, although the mode of its pretended formation is so extraordinary and mysterious; and, with respect to the formation of valerianic acid from indigo, this excellent chemist dispenses even with the odour of that acid: the formula which he gives must, in itself, suffice to prove the correctness of his supposition!

"It is quite evident that M. Gerhardt is extremely easy and indulgent in the demands which he proposes to himself to prove the correctness of his own views; but we shall immediately see how exacting this gentleman grows when the views and assertions made, and even the very plainest facts stated by other chemists, are submitted to his critical inspection."

To overthrow this evidence M. Gerhardt at length asserted that there is no such thing as nitrite of oxide of ethyle.

"I think," says Liebig, "these examples will suffice to characterise M. Gerhardt's discoveries, and I will now proceed to examine his mode of investigation.

"In his first notice on the composition of chinoline, (*Ann. der Chemie und Pharmacie*, vol. xlii., p. 312,) M. Gerhardt assigns to this base the formula, $C^{18}H^{12}N^2O^2$, whilst, subsequently, he gives the formula, $C^{36}H^{40}N^4$. According to the first formula, chinoline contains oxygen, whilst, according to the second, it contains none. These are things, of course, which may happen to any chemist; but what follows here is highly characteristic of M. Gerhardt's method of proceeding in his investigations.

"His first formula rendered it a rather difficult and intricate task to explain the formation of chinoline from chinine cinchonine, &c. Well, now for the way in which M. Gerhardt got rid of this difficulty. His own analyses of chinoline were, of course, faultless; the existing want of correspondence between his formula of this substance and the formulæ of chinine cinchonine and strychnine was simply to be imputed to the defective analyses which *other* chemists had made of the latter substances: nothing was more easy than to prove the incorrectness of these analyses. 'At any rate,' says M. Gerhardt, 'the formula which Regnault assigns to chinine is incorrect; I have, however, reason to believe that his analyses are correct. Now, from these analyses, I calculate the formula for chinine as $C^{36}H^{44}N^4O^4$. My recent analyses confirm those of Regnault; I simply correct his formula, $C^{40}H^{44}N^4O^4$.' By the application of this exceedingly simple and ingenious process, M. Gerhardt managed to explain the formation of the chinoline: the correctness of his formula could no longer now be called in question.

"But after this appeared the new formula, which assigns more carbon and no oxygen to chinoline. How did M. Gerhardt proceed now? He restored the old formula by the simple waving of his magic wand. Chinine is now no longer $C^{36}H^{44}N^4O^4$, but, just as I myself discovered eleven years ago, $C^{40}H^{48}N^4O^4$. Strychnine is no longer $C^{40}H^4N^4O^4$, but $C^{44}H^{48}N^4O^4$.

"Now what can be said of a mode of investigation like this, particularly if it be taken into account that even the new formula which M. Gerhardt now gives for chinoline has been corrected by Dr. Bromeis, in the proportional amount of hydrogen which M. Gerhardt assigns to it."

With respect to that singular substance melam, discovered by Liebig, Gerhardt observes that his experiments prove it to be simply a mixture of mellon and melamine; to this the Baron applies the following observations:—

"These statements of M. Gerhardt I could consider in no other light but as an exposition of results which this chemist obtained during an actual investigation of the mellon compounds. I had the less reason to doubt this, as M. Gerhardt alleges that the results of his *experiments* led him to the conclusion, that the body to which I have assigned the name of melam is simply a mixture of mellon and mellamine. Now this conclusion seemed to me at once to throw a very suspicious light upon the rest of the inferences and deductions contained in M. Gerhardt's communication to the Royal Academy; for melamine is readily soluble in hot water, whilst melam is not so; and, again, the latter substance dissolves completely in hydrochloric acid, whilst mellon resists the solvent action of this acid. Yet, notwithstanding this, M. Gerhardt's statements on mellon and mellon compounds, induced me again to investigate these substances. In vol. l., p. 1, of the *Annalen der Chemie und Pharmacie*, I gave a description of the order in which the chemical changes attendant upon the fusion of dry ferrocyanide of potassium, in conjunction with sulphur, occur, and stated that the process of transformation passes through three distinct periods. In the first period, sulphocyanide of potassium is formed, and protocyanide of iron separates; in the second period, sulphoprotocyanide of iron is formed, and in the third period, at a red heat, sulphuret of carbon is evolved, and sulphocyanide of iron formed, and the fused mass contains now mellonide of potassium. The mellon of the mellonide of potassium is derived here from the sulphocyanide of iron; sulphocyanide of potassium by itself suffers no alteration, even at the most intense red heat; it evolves no sulphuret of carbon; it yields neither sulphuret of potassium nor mellonide of potassium. As far as our present investigations will enable us to judge, the ignited ferrocyanide of potassium contains neither hydrogen nor oxygen, nor have we yet been able to discover the presence of either of these elements in sulphur or in iron. None of the products formed by the mutual reaction of these substances can, therefore, contain hydrogen or oxygen.

"Now, let us see what M. Gerhardt says to these experiments. Since January, 1844, M. Gerhardt has undertaken to publish a general report of the progress of chemistry, more particularly in foreign parts. The first

number of these *Comptes Rendus* contains a promise to the effect that they shall fully deserve the epithets, '*complets, serieux, et concis.*' Well, strange to say, M. Gerhardt, in his report of my investigation of the mellon compounds, in these *Comptes Rendus complets*, gives only two of my methods for the production of mellonide of potassium, omitting the third and principal method altogether: this omission is, of course, simply *accidental*, I suppose. In a note to this report, M. Gerhardt states that none of my methods proved successful with him, although he made his experiment upon a whole pound weight of substance, and acted strictly according to my instructions; and moreover, that two other well-known chemists failed equally in this attempt. I do not wonder at this at all; far from it; yet I think I may venture to ask, *which* method did M. Gerhardt pursue to produce the mellon compounds, the analyses and formulæ of which he communicated to the Academy? Either he *did* succeed with one of my methods, and *did really* produce the salts which he professes to have subsequently analysed, or he he did *not* succeed with any of my methods, and consequently did *not* produce the salts nor analyse them. I can draw no other inference from his note."

During a careful review of the report of M. Gerhardt on the formation of mellonide of potassium, M. Liebig asserts that his observations on these substances have been misrepresented by his opponent, who has also taken advantage of a palpable misprint to suit his purpose.

"I am firmly convinced," says M. Liebig, "that the whole structure of perverted inferences and *invented* analyses which it pleased M. Gerhardt to erect, is based simply upon these misprints; so, that in this instance, I have every reason to feel obliged to the carelessness of the corrector." This misprint occurred in the analysis of hydrosulfocyanic acid, which was said to yield in the two experiments—

1. To 100 of carbonic acid 19·62 water
2. To 100 „ 27·62 „

Whereas, it ought to have been printed—

1. To 100 of carbonic acid 9·62 water
2. To 100 „ 7·62 „

M. Laurent, in concert with whom M. Gerhardt was acting, is thus addressed:—

"I cannot let this occasion pass without offering a few remarks on M. Laurent, who has thought proper to associate himself with M. Gerhardt.

"I consider M. Laurent one of the most talented and ingenious chemists of the present time; but, unfortunately, nature has bestowed upon him so high an ambition, desire of power, and such jealousy, especially of his own countrymen, that he disdains even the most splendid results of his own labor, if he cannot shape them into instruments to deprive others of the honors which they are justified to claim as the reward of their conscientious labors; the successful labors of others are meritorious only in as far as they may contribute to his personal glory, whilst he looks upon their failures and mistakes as crimes for which no punishment can be deemed too severe. All the productions of his mind seem to have for their object to detract from the merit of others, and to cover himself, at their expense, with tinsel, like a stage hero. He considers the whole science centered in himself. And what is the result of his vain efforts to compel all other chemists to bow to his infallibility, and to circumscribe the exercise of their own faculties and judgment within the narrow limits that he would fain assign to them? His egregious pretensions neutralise completely all the beneficial results which his labors would otherwise not fail to produce.

"It is to this truly lamentable bias of M. Laurent's mind that we are indebted for the successive series of physical laws with which this chemist has been pleased to enrich our science, and which are mutually opposed to one another. We German chemists have long since felt surfeited with these laws, and it is not so easy to induce us to swallow any more of them.

"How dim appear even the brightest stars in the chemical horizon by the side of the refulgent luminary that shed its lustrous rays over M. Laurent's birth! Where are the physical laws discovered by Laplace, Berthollet, Gay-Lussac, Dulong, Chevreul, Dumas, Pelouze, Frémy, Malaguti, Péligot? They all sink into utter insignificance when compared with the immense wealth which M. Laurent has already showered, and still continues to shower, upon us, from the inexhaustible mine of his wisdom! But, alas! who can avoid his fate? Whilst M. Laurent endeavors to arrogate to himself an exclusive supremacy in science, he finds even his just claims and real merits altogether disregarded by other chemists. The one is, no doubt, just as wrong as the other; but such are the dispositions and passions of the human mind.

"Thirsting thus for excessive admiration, ambitious, envious and jealous of others, M. Laurent discovered in M. Gerhardt, a man of similar disposition, and the conclusion of an alliance between these two chemists was the consequence.

"M. Laurent makes experiments which irrefutably prove the correctness of M. Ger-

hardt's observations and deductions, whilst M. Gerhardt, on his part, proves the infallibility of M. Laurent's dicta. The chemist of mixed descent (half German half French) undertakes the slaughtering of the Germans; whilst the other, of pure French blood, makes *autos da fé* of French heretics. It might be imagined, perhaps, that, to balance matters, M. Gerhardt favors the French, and that M. Laurent, on his part, smiles benignantly upon the Germans. But any such supposition would be altogether groundless. Thus, for instance, in my work on "Organic Chemistry," which M. Gerhardt has translated into French, I intended to acknowledge the great merits of certain French chemists. The following passage occurs at p. 1004 of the German edition of that work, in the chapter on fatty substances:—'The principle upon which organic investigations are based at present—viz., to subject a substance to a series of changes and modifications, to investigate the mutual connexion and relations of the latter, and to infer, finally, from the results of this investigation, the nature of the examined substance—this principle, I say, we owe to Chevreul. This principle led Chevreul upon the true path to numerous discoveries, and kept him safe from error at a time when there was nought but error and confusion in organic chemistry. At that time, when the high importance and value of this principle remained still unappreciated, observations and analyses were indeed made, but none that could serve to throw light into the impenetrable darkness. It was as late as 1824 when Dumas and Boullay applied this principle to the examination of the compound ethers, that its application to organic investigations gave the first impulse to the extraordinary development which chemistry has since then attained.'

"Now, this whole passage M. Gerhardt has thought proper to suppress in his translation, without asking or caring whether this extraordinary mutilation was likely to be acceptable to me or not. The consequence of M. Gerhardt's conduct was that I lost the friendship of one of the best and most noble of men."

In the *Comptes Rendus* of the Academy, MM. Laurent and Gerhardt promulgated a new law applicable to those organic compounds which contain nitrogen, arsenic, and phosphorus.

"The law is—the sum of the atoms of nitrogen and hydrogen, is in all organic compounds divisible by four."

These chemists applied this law to various substances, and M. Gerhardt, in consequence, proposed the application of new equivalents to these substances.

With respect to the experiments by which these new equivalents were decided, M. Liebig asserts that they are mere inventions of M. Gerhardt. Again he observes:—

"The law of MM. Gerhardt and Laurent, or rather what these gentlemen are pleased to call by that dignified name, is utterly wanting, in every essential quality, of a true physical law.

"What is an atom of nitrogen, phosphorus, arsenic? We are altogether in the dark upon this point; and as to the *equivalent* of nitrogen, this is still a matter of doubt and dispute among chemists. These things are mere assumptions, upon which no physical law can possibly be based. If Berzelius, instead of his laborious investigations, had pursued the same short and easy road as these gentlemen; if, instead of devoting years of toil to the task of advancing and establishing the science, that great chemist had contented himself with arbitrary alterations of Richter's and Wenzel's results, where would MM. Laurent and Gerhardt be? That there may be a grain of wheat hidden in the dunghill they have raised, I willingly believe, and I deem it very meritorious to endeavor to find and bring it to light; but it is truly pitiable to see these copartners strutting about on the dunghill like conceited cocks, and to hear them cackle forth to the listening crowd of simple chickens, a marvellous tale about the beauty, magnitude, exquisite flavor, and other excellencies of the said grain. The most rapid growth in nature proceeds silently. The truly wealthy speak least of their possessions.

"These so-called laws are at best but rules, which may stand until exceptions are discovered. I now leave M. Laurent, and return to M. Gerhardt."

M. Liebig then proceeds to make a series of severe remarks on a work of M. Gerhardt's, published under the title of *Precis de Chimie Organique*. "Subtract," he observes, "from this precious *Precis*, the beautiful ideas of Persoz, and what remains? A monument of the grossest fallacies that have ever appeared in print, and withal of the most audacious and unbounded licence: every page furnishes proofs of this assertion—let me select a few.

"At page 430 of the French edition, M. Gerhardt treats of allanturic acid; to which he assigns the composition $C^8 H^4 N^2 O^8$; and to this he appends the following annotation:—

"'The formula of M. Pelouze—$C^{10} H^{10} N^3 O^{10}$—corresponds to the formula $C^8 H^{4\cdot2} N^{2\cdot7} O^{8\cdot4}$, which I, by converting the decimals into units, express by $C^5 H^4 N^2 O^4$.'

"The reason for which M. Gerhardt makes this alteration is explained in the next page.

"'MM. Liebeg and Wöhler describe, under the name of mykomelinic acid, a product of the action of ammonia upon alloxan: this product is, to all appearance, identical with the allanturic acid of M. Pelouze. If this supposition be correct, as we believe it is, we may assume that the action of ammonia upon alloxan, produces first water and allantoin, and subsequently urea and mykomelinic acid—$C^8\ H^4\ N^4\ O^8$.'

"'I have just now shown how M. Gerhardt manufactured his formula for allanturic acid; by the same trick he has succeeded in translating our (Professor Wöhler's and my own) formula for mykomelinic acid, $C^8\ H^{10}\ N^8\ O^5$, into $C^8\ H^4\ N^2\ O^2$! Two things may be learned from this—viz., 1, the art of getting at correct formulæ; and 2, an easy method of proving the identity of two substances.

"To find the correct formula for a substance, it is simply necessary to divide by any given number the proportions calculated from the analysis of the substance in question, and should this lead to fractions, to convert the latter into units. The process of proving the identity of two substances, is now of marvellous simplicity; it is a close imitation of the shoemaker's system, whose shoes fit everybody alike: if the feet happen to be too large for the shoes, he cuts off the toes and heels, and if too small, he stuffs the superfluous space with straw. That allanturic acid is colourless, and deliquescent in the air, (*Precis*, i., p. 431,) whilst mykomelinic acid is yellow, and insoluble in water, has, of course, nothing whatsoever to do with the matter, according to M. Gerhardt's notions.

"This, perhaps, may suffice for a picture of M. Gerhardt; but I will still add a few finishing touches.

"In the same manner in which M. Gerhardt manages to prove the identity of allanturic acid with mykomelinic acid, he converts the formula of ammelide, $C^6\ H^9\ N^9\ O^3$, as found by myself, and confirmed by Knapp, into $C^3\ H^4\ N^4\ O^2$. (*Precis de Chimie Organique*, vol. i., p. 442.)

"A short time ago, Professor Wöhler and myself described a peculiar process of decomposing urea, in which we obtained a substance that, like ammelide, was resolved by the action of alkalies and acids into ammonia and cyanuric acid, but differed in its composition from ammelide.

"To the report which M. Gerhardt gives of this new substance in the *Comptes Rendus, complets, concis, et serieux*, he appends the following remarks:—'MM. Liebeg and Wöhler look upon this substance as new; this supposed new substance is, however, simply ammelide. I have made several experiments upon it, and, among others, I have produced and analysed the silver salt of Knapp, which is composed of $C^3\ (H^3\ Ag)\ N^4\ O^2$. Had MM. Liebig and Wöhler looked to the formulæ for ammelide given in my work, they would have seen at once that the properties of their supposed new body correspond perfectly with those of ammelide. I shall shortly take occasion to prove the identity of the two substances in a paper on the mellonides which I intend publishing.'

"Finally, M. Gerhardt adduces the following experiment:—'If urea is exposed to the action of a gentle heat, pure ammonia and carbonate of ammonia alone are evolved, and the residue consists of pure ammelide.'

"But it most singularly happens that our new substance is produced by distilling urea very rapidly, and at the highest possible temperature. With regard to M. Gerhardt's statement concerning the composition of Knapp's silver compound, it has evidently escaped his memory that he had already, at page 442 of his *Precis* found his new formula of ammelide, by dividing by 2 my formula of this substance, and converting the fractions subsequently into units, and that he had thus already arrived at the discovery of the ammelide, which is produced by the decomposition of urea.

"Dr. W. Hofmann, in his paper on the investigation of the organic bases in coal-tar, (*Annalen der Chemie und Pharmacie*, vol. xlvii., p. 18,) after stating that he had felt inclined to consider leucol as identical with chinoline, remarks, that this view is opposed principally by the deportment of the former substance with chromic acid.

"Whereupon M. Gerhardt, in his *Comptes Rendus, complets, concis, et serieux*, p. 31, January, asserts at once, 'I have also reason to believe that the leucol of Runge is identical with chinoline;' of course without making the slightest mention of what Dr. Hofmann had stated on this point.

"Dr. Hofmann has, since then, found means to clear the objection which the deportment of leucol with chromic acid raised against the assumed identity of leucol with chinoline. He has not, as yet, published his recent observations, and thus M. Gerhardt has still an opportunity left him to vindicate his conduct in this affair, by fairly stating the reasons that induced *him* to believe in the indentity of leucol with chinoline.

"Every chemist knows M. Wertheim's excellent paper on the oil of garlic, (*Annalen der Chemie und Pharmacie*, vol. li.,) and, likewise, Dr. Will's paper on the oil of mustard, (*Ibid*, vol. lii.) At the conclusion

of his paper, Dr. Will points out the relations existing between the oils of garlic and mustard, in the following words :—'Wertheim's investigation contains, as I believe, the key to the constitution of the oil of mustard; if we consider this oil as a sulphocyanide of allyle, we shall get the following series :—

'Allyle . . .	$C^6 H^5$	
Oxide of allyle	$C^6 H^5 O$	(produced by Wertheim.)
Protosulphuret of allyle . .	$C^6 H^5 S$	oil of garlic.
Sulphoprotocyanide of allyle	$C^6 H^5 S^2 Cy$.	oil of mustard.'

"These remarks speak for themselves; every body must see at once what Dr. Will intended to convey by them. This chemist would have spoken more explicitly had he succeeded in his attempts to convert the oil of mustard into oil of garlic, by means of potassium. But this discovery was reserved for M. Wertheim, who has thus enriched chemistry with one of the most beautiful proofs of the existence of compound radicals.

"M. Gerhardt's *Comptes Rendus, complets, concis, et serieux*, contain an account of these investigations of MM. Wertheim and Will; but in this veracious report, every allusion to the relation which Dr. Will points out as existing between the oils of garlic and mustard is most carefully avoided. M. Gerhardt had then already resolved to use the existence of this relation between the two substances as the foundation of a *discovery* of his own; indeed, the very next number of his *Comptes Rendus* contains the announcement of this *discovery*. 'En faisant réagir du potassium sur l'essence de moutarde, j'espérais enlever le cyanogène ainsi qu'une partie de soufre et mettre l'essence d'ail en liberté. Mes prévisions se sont entièrement réalisées. C'est une jolie expérience de cours.'

"If we subtract the formula of the oil of garlic from that of the oil of mustard, there remains sulphur and cyanogen in this proportion, that potassium ought to form sulphocyanide of potassium, on the one hand, (with the sulphur and part of the cyanogen,) and cyanide of potassium, on the other hand, (with the rest of the cyanogen.) The oil of garlic $C^6 H^5 S$ contains 66·31 per cent. of carbon.

"The proofs which M. Gerhardt adduces in support of his assertion, that he did actually succeed in converting the oil of mustard into oil of garlic, appeared to him quite irresistible. One of these proofs is, that the product of the distillation of the oil of mustard with potassium, yielded only 58·8 per cent. of carbon, instead of 66·31 per cent.; (no mention whatsoever being made of a determination of the sulphur); and another of these proofs is, that the residue contains neither sulphocyanide of potassium nor cyanide of potassium.

"It will be seen from this, that M. Gerhardt's discovery of the transformation of the oil of mustard into oil of garlic, is surprisingly simple; with the exception of the proof furnished by M. Gerhardt's organ of smell, all other proofs speak directly against his assumption; but what do such proofs signify when the subject in question is to verify one of the most important facts in chemistry?

"M. Wertheim has recently published his experiments on the transformation of the oil of garlic into oil of mustard, and, vice *versa*, of the latter into the former; these experiments suffice to determine the real worth of M. Gerhardt's *experiments*.

"With respect to the manner in which M. Gerhardt has ventured to treat M. Regnault's (*Comptes Rendus, complets, concis et serieux*, Feb., p. 64,) I am altogether unable to find words sufficiently strong to express my indignation.

"M. Gerhardt's conduct, for the last few years, has appeared to me that of a true booter, who, from his ambush, (the *Comptes Rendus, complets, serieux, et concis*,) falls upon and plunders the quiet traveller, and then decks himself in his spoils. But this cannot be allowed to proceed further."

EXPERIMENTS ON SEVERAL OF THE DOUBLE SALTS FORMED BY THE OXIDES OF THE MAGNESIAN GROUP.*

BY M. J. ISIDORE PIERRE.

THE care of the collection of the products of the laboratory of the Ecole Royale des Mines, having been entrusted to me, I have latterly directed my attention in an especial manner, to the study of the double salts formed by the oxides of the magnesian group, namely, the oxides of magnesium, copper, zinc, nickel, cobalt, manganese and iron.

We have been long aware that this class of double salts, performs a very important part in chemical analysis, by the disturbances they frequently introduce into the ordinary action of tests; at the same time some among them are but little known.

The number of these compounds is increased every day, and if we were inclined to notice all the works that have a direct or indirect connexion with them, it would be to mention the name of almost every chemist.

* *Comptes Rendus*, Dec. 29, 1845.

The preparation of these compounds is in general easily performed, by mixing together equivalent solutions of the two salts we wish to combine. They are almost all remarkable for their beautiful crystalline forms.

I gave the preference, as the first object of my studies, to the double sulphates and chlorides, because they are more easily analysed, and are consequently the most proper to render evident the analogies and the characteristic resemblances of composition, that may exist between the different groups of analogous compounds formed by these different oxides.

The study of the sulphates had a peculiar interest, because it gave me an opportunity of verifying or impugning the conclusions of Mr. Graham, with respect to that which he has called *saline water*.

This chemist, as we know, imagined that he had observed:—1. That in the cases of the sulphates of zinc, magnesia, iron, manganese, copper, nickel and cobalt, one of the equivalents of the water could only be eliminated at a temperature far above that which is necessary to drive off the others. 2. That this equivalent of water could be replaced by 1 equivalent of another salt: so that the double salt thus formed contains 1 equivalent of water less than if each of the two simple sulphates had furnished the whole of its water of crystallisation, to the molecule of double salt resulting from their combination.

As the results I have obtained do not confirm the views of the celebrated English chemist, I thought it was my duty to describe in some detail, the analysis I have made; the results of which I now have the honour of laying before the Academy.

Analysis led me to the following usually admitted formulæ, in the case of sulphate of zinc, crystallised below 15 degrees.

$$Zn, SO^3 + 7HO;$$

for sulphate of magnesia, to the formula

$$MgO, SO^3 + 7HO;$$

for sulphate of nickel, I have found

$$NiO, SO^3 + 6HO,$$

a formula which differs by 1 equivalent of water from that which has been admitted on the authority of M. Mitscherlich, for sulphate of copper crystallised at the ordinary temperature.

$$Cu, SO^3 + 5HO.$$

Mr. Graham stated, that one of the equivalents of water in these compounds could only be eliminated at a temperature above 482° F.; I have notwithstanding succeeded in removing the whole of the water at a temperature of about 230° F., in a current of dry air sustained for a sufficient time; this current was sometimes kept up for fifteen or eighteen consecutive hours.

Mr. Graham discovered for the composition of the double sulphate of zinc and potash,

$$KO, SO^3; Zn Ni SO^3 + 6HO,$$

and for that of the double sulphate of copper and potash,

$$KO, SO^3; CuO, SO^3 + 6HO.$$

I have found, on the contrary, that the sulphates of zinc, nickel and copper, in combining with each other retain the whole of their water.

Thus analysis gave me for the composition of the double sulphate of zinc and potash,

$$KO, SO^3; ZnO, SO^3 + 7HO;$$

for that of the sulphate of zinc and ammonia,

$$Ni H^4 O, SO^3; ZnO, SO^3 + 7HO;$$

for that of the double sulphate of zinc and magnesia, crystallised at the ordinary temperature,

$$Mg O, SO^3; ZnO, SO^3 + 14HO;$$

for that of the double sulphate of nickel and zinc,

$$ZnO, SO^3; NiO, SO^3 + 13HO;$$

for that of the sulphate of nickel and potash,

$$KO, SO^3; NiO, SO^3 + 6HO;$$

for that of the sulphate of copper and potash,

$$KO, SO^3; CuO, SO^3 + 7HO.$$

It is probable that this property may also exist in the case of salts that can crystallise with different quantities of water, according to the temperature at which their crystallisation took place; at least I have ascertained that, the sulphates of zinc and magnesia, each of which, as we know, crystallise with 5 equivalents of water at a temperature of from 86° to 104° F., can combine together with their 5 equivalents of water at that temperature, and form the salt

$$Mg, SO^3; ZnO, SO^3 + 10HO.$$

In the last place, I have found for the formula of the double sulphate of magnesia and potash,

$$MnO, SO^3; KO, SO^3 + 4HO;$$

for that of the double chloride of potassium and zinc,

$$KCl, Zn Cl;$$

for that of the double chloride of ammonia and nickel,

$$Ni H^4 Cl, Zn Cl;$$

that is to say, that the chlorides of potassium and ammonia can form double anhydrous salts and combine with the chloride of zinc.

These analyses are not in sufficient number to enable one to deduce with certainty the law of the composition of double salts of which they seem to give evidence; but I think they open a new mode of investigation which may throw some light on the theories

that now divide the opinions of chemists, and this it is that has induced me to publish them.

The work is not by any means as complete as I could have wished it to have been, but, as I know not when it will be possible for me to finish it, I thought that, incomplete as it is, it might be of some interest, whether in the point of view taken of the subject by Mr. Graham, or with reference to the theory of dualism.

AN ACCOUNT OF A NEW CRYSTALLISED ARSENIATE OF COPPER AND AMMONIA*

BY M.A. DAMOUR.

About a year since, M. Damour presented to the Academy a memoir on the arseniates of copper, he now describes a new arseniate of copper, formed artificially, in the humid way, and which he has obtained in a crystallised form. This salt when submitted to analysis proved to be a composition defined by the following formula :—

$$Cu^6As + 3(NisH^3) + 4H,$$

namely—

1 atom	arsenic acid	0·3897
3 ,,	oxide of copper	0·4032
3 ,,	ammonia	0·0851
4 ,,	water	0·1220
		1·0000

Its color is skyblue.

Its primitive form is a doubly oblique crystal in which

M over T = 119°,·0′; P over M = 120°·45′;
P over T = 126°·17′.

Its specific gravity is equal to 3·05.

It is insoluble in water either cold or boiling.

It remains unchanged when exposed to air and light.

At the temperature of 572° F. a considerable quantity of water and ammonia are disengaged.

Heated in a glass tube, to a dull red heat, it is completely decomposed; its principal constituents reacting, then, upon each other. A portion of the arsenic acid is carried off by the hydrogen of the ammonia, under the form of arsenious acid, which is volatilised and condensed on the sides of the tube. After decomposition the residue is of a brick-red color. If the heat is still further increased, it melts, and adheres to the sides of the tube.

* *Comptes Rendus*, Dec. 29th, 1845.

ON THE NEW-LY DISCOVERED RELATIONS BETWEEN ELECTRICITY, LIGHT, AND MAGNETISM.*

(Part of a Letter from Professor Faraday to M. Dumas).

If we advise the magnetic line of force, produced by a powerful electro-magnet, or by a helix, to pass through a transparent body parallel to a ray of polarised light, passing through the same body, the polarised ray of light will assume a rotatory motion. This effect is produced in all transparent bodies, whether liquid or solid, not possessing double refraction, but in different degrees, according to the nature of the substances. In this, I see a magnetic force acting on the ray of light itself; but several of my friends who, however, have not taken all the facts of my memoir into consideration, believe that this phenomenon proves nothing of the kind. Thus, although my opinion remains the same, I willingly acknowledge that it may be erroneous.

If the ray of light revolves to the right, from a certain direction give to the magnetic power, or the current in the helix, it will move to the left when a contrary direction is given to the magnetic or electric forces. I imagine that the rotation depends essentially on the direction of these forces, and this constitutes the extraordinary difference I am about to explain, between this rotation and that produced by quartz, sugar, oil of turpentine, &c.

Place in the helix, side by side, a certain quantity of water, and a tube containing oil of turpentine. If the oil rotates to the right, pass an electric current through the helix, in such a manner as to produce a rotation to the right, the water in the tube will then rotate to the right, and the two liquids will exhibit the same action.

Leaving now the tubes, the helix, and the current, in the state we have just described, let us pass the polarised ray through the tubes in a contrary direction, and place ourselves to observe the experiment at their opposite extremity, we shall still see the oil of turpentine turn the ray towards the right, but it will not be the same in the case of the water, that will turn the ray towards the left. The rotation is absolutely determined by the direction of the electric current, which moves it in its circuit, and which, viewed from this extremity, passes towards the left.

If, instead of water, there was oil of turpentine in the helix, and the electric current was sufficiently powerful to produce a rotation on the luminous ray, equal to that

* *Comptes Rendus*, Jan. 19, 1846.

produced in the oil, its rotatory power, observed in a ray passing in a certain direction, would appear doubled; while, examined in a ray passing in a contrary direction, it would be reduced to zero.

This is the fact on which I particularly rest my opinion against that of my friend, or rather several of them.

These are the results at which I arrive as to the magnetic state of matter. I find that all matter, whether solid or liquid (perhaps even in a gaseous form), is affected by the magnet, but not in the same manner as iron. A magnetic substance like iron is attracted by the magnet, and a piece of such a substance, if of a lengthened form, places itself in the direction of the magnetic force, while a substance that does not possess the same species of magnetism as iron, is repelled by the magnet, and a lengthened piece of such a substance takes a direction tranverse to the line of the magnetic force. Water, alcohol, ether, oil, wood, flesh, blood, and a thousand other substances bear this relation to magnetism; but the best perhaps are, ponderous spar, phosphorus, antimony, and bismuth. Perhaps you may remember, (it is now I believe nearly thirty years since) M. Lebailif, of Paris, exhibited the repelling power of the magnet, in the cases of antimony and bismuth. I have mentioned this fact in a general manner, and I have cited it in my memoir.

Having called those substances which are not magnetic, after the manner of iron, by the name of *dimagnetics*, I have retained this name to express this new magnetic state, and in conclusion, I can say that every liquid or solid substance is subject to magnetic influence, being, in its nature, either magnetic or dimagnetic.

From this property, and from its study, a number of curious conditions arise, on which account I shall be obliged to send you my memoir, which I will forward to you as soon as possible.

Among other things, I have proved, that all the usual compounds of magnetic metals, are also magnetic. Thus, it is not only the oxides of iron that are magnetic, as M. Becquerel, and others, have observed, but all the salts of iron are equally so, and all the solutions of these salts, if sufficiently concentrated to counterbalance the dimagnetic force of the water, or alcohol, employed as solvents.

By proceeding in this manner, I have been able to show that cerium is a magnetic metal, for all its salts are magnetic, and it is the same in the case of chrome and manganese.

OBSERVATIONS ON PROFESSOR FARADAY'S LETTER ON LIGHT AND ELECTRICITY.*

BY M. POUILLET.

When the Academy met on Monday, the 26th of January, several communications on the above subject were laid before it. M. Pouillet described, at great length, an apparatus by which he had endeavoured to repeat Professor Faraday's experiments, but in this he succeeded but imperfectly, having obtained no very satisfactory results; he concludes his paper with the following observations:—

"These negative results cannot, in any manner, weaken the general proposition of Mr. Faraday, who no doubt operated with greater care or with more powerful magnets. There is another method for studying the properties of magnetism, namely, that formerly employed by Coulomb, when he discovered that all bodies are subject to the influence of magnetism, this method has been, since his time, adopted by many philosophers. Mr. Faraday appears to have resorted to it, but, no doubt, on account of the weakness of my electro-magnets, although excited by a battery of one hundred pairs, I have not obtained the same results as he has: in my experiments, bismuth and amber were the only two substances that assumed a direction perpendicular to the line of the poles, and we shall no doubt be struck with the resemblance of this direction of bismuth, and the effect produced by repulsion on the fine powder of these substances when placed over a magnet."

M. Pouillet here alludes to a curious property possessed by powdered bismuth; when the powders of magnetic metals are sprinkled on a piece of thin paper, placed over the poles of a powerful magnet, they arrange themselves in a circle, but in the case of bismuth, two concentric circles are formed, leaving a narrow white band at the place where the other metals form their circle.

"The effect is so well marked, that by mixing, for example, very finely powdered sesquichloride of chrome with bismuth, also in fine powder, we see the violet circle of the chloride, and the two circles of bismuth, which are separated, although extremely close to each other.

"These two mechanical actions of magnetism on bodies; the attraction and repulsion of fine powders, placed almost in contact with one of the poles, and the direction given to more considerable masses oscillating in the presence of the two poles, appear to be dependant one on the other;

* *Comptes Rendus*, Jan. 26, 1846.

but how far are they connected with the mixed action, the optical action discovered by Mr. Faraday?

"Admitting, with this philosopher, that all those substances which are not magnetic, like iron, are dimagnetic, or magnetic in the same manner as bismuth, we should be immediately led to conclude that the optical action being concomitant with a certain mechanical action, it is at least probable that this action is exercised on the substances, and not directly and immediately on the light that passes through them.

"But if it happens—as in my experiments, whether on account of the relative want of power of my magnets, or from other causes—if it happens, that glasses of different kinds, distilled water, fatty substances, &c., which are so sensible to optical action, are nevertheless insensible to the mechanical action of magnetism, it would be no reason to conclude that magnetism acts directly on light itself, a conclusion, which, in other respects, would have no precise meaning, excepting under the theory of emission, because under the theory of undulations, which appears now to be so completely demonstrated, it is the ether of the bodies submitted to the test, that would be modified by magnetism; and it would, no doubt, be extremely difficult to determine whether it is modified without any participation on the part of the ponderable matter, to which it is so intimately attached."

ON THE DIGESTION OF STARCH AND SUGAR, AND ON THE PART WHICH THESE MATTERS PERFORM IN NUTRITION.*

BY MM. BOUCHARDAT AND SANDRAS.

These chemists have been occupied for some time with the study of the manner in which the immediate principles that form the bases of our aliments are affected in the digestive organs; and in the pursuit of these investigations have latterly directed their attention to the changes which sugar and starch undergo during the process of nutrition.

They fed dogs on cane sugar for some days, and subsequently detected this principle in the whole extent of the alimentary canal, in part under the form of cane sugar, in part in a transitional condition, and in part in the state of lactic acid. The urine, blood, chyle, and bile of these dogs also contained traces of transitional sugar and lactic acid.

The authors regard it as demonstrated, that to become destroyed in the blood, the sugar must previously have been changed in the digestive tube. The ultimate products of this destruction are water and carbonic acid.

Man and the carnivorse very incompletely digest raw starch. Amongst the herbivorse this digestion is more easy, without being complete. In their intestine, under the influence of a temperature of 104°, of the surrounding slightly alkaline fluids, and of a secreted matter approaching in its property to diastase, but not nearly so energetic, the starch becomes partially transformed into glucose, lactic acid and dextrine; substances that are likewise found in the bile and in the blood.

Moreover the blood of the vena portæ contains in these animals more water, and more combustible products than arterial blood. In granivorous birds, starch undergoes a digestion nearly complete. The grains of this substance are converted into dextrine, glucose and lactic acid, at the temperature of 104°, with a strong alkalinity, and the presence of a substance very analagous to diastase. The cells and fibres are even themselves disaggregated, and undergo a commencing solution.

The blood of the graminivrae also contains glucose, dextrine and lactic acid.

Man and carnivorse only digest starch when the grains have been deprived of their envelopes by boiling; but even under such circumstances the solution of the starch takes place very slowly.

An important condition for the digestion of sugar and starch, is the slowness of the introduction of these matters into the circulatory torrent. Whenever too considerable a quantity is introduced in a short space of time, they are eliminated by the kidneys. Amongst other functions, the liver contributes to prevent the penetration into the blood of substances derived from starch, in a manner too copious and sudden.

The ideas brought forward by the authors of this memoir, are opposed to the theory which supposes the transformation of the aliments into chyle, before their admission into the blood: but if we consider that after the ingestion of saccharine solutions mixed with coloring matters, the chyle never contains any of these substances whilst the bile does contain them, we must admit that it is by the vena porta, and not by the lacteals that sugar and the derivatives of starch are absorbed.

* *Medical Times.*

ON THE EQUIVALENTS OF SOME SIMPLE BODIES.*

BY J. PELOUZE.

The method adopted by the author is that proposed by Gay-Lussac. Pure silver is weighed off on a fine balance which will indicate accurately ½ of a milligramme, and from 2—6 grms. of it dissolved in nitric acid in a flask with a ground stopper capable of holding 200 cubic centimetres, and the solution diluted with 100—150 grms. water, and the chlorine compound introduced. If this is solid, it is transferred directly from the balance into the flask; but if liquid, it is weighed in a small tube, sealed before the blowpipe, then conveyed into the flask containing the silver solution, and broken in it by violent agitation. The liquid is clarified by shaking, and the precipitation continued with a very dilute solution of silver, in which the amount of silver is accurately known, until the liquid is no longer rendered turbid. In other respects the author observed the directions given by Gay-Lussac in his treatise on the analysis of alloys of silver in the moist way. With some practice the error cannot amount to more than one-half or even one-fourth of a thousandth of the silver employed. The author came to the following results, assuming the equivalent for chlorine to be 443·20, and that for silver 1349·01 :—

EQUIVALENT OF SODIUM.

100000 silver were precipitated by 54158—54125—54139 chloride of sodium; the mean of these three experiments gives for the equivalent of sodium 287·17, and for that of chloride of sodium 730·37. The chloride of sodium had been prepared by decomposing sulphate of soda with chloride of barium and carbonate of soda by hydrochloric acid. The salt was crystallised several times, and either dried at 392° or fused, and in both cases yielded the same results.

POTASSIUM.

The chloride of potassium was obtained by igniting chlorate of potash; it was recrystallised and dried in the same way as the chloride of sodium. The mean of three experiments yielded for the equivalent of chloride of potassium 932·50. Marignac obtained 932·34, Levol 932·49; the equivalent of potassium, is accordingly 489·30, which agrees accurately with that found by Marignac, viz. 489·14.

NITROGEN.

In the first place, crystals of chloride of ammonium were employed which had separated from an aqueous solution, but in the second case the sublimed salt. 100 parts silver were precipitated by 49·536—49·517 chloride of ammonium, which gives for the equivalent of this salt 668·38, and for that of nitrogen 175·08.

BARIUM.

The chloride of barium was purified by several successive crystallisations, and then dried in the oil-bath at 392°, or in a glass tube just below red heat. 100 parts silver were precipitated by 96·454—96·466—96·468 chloride of barium; hence the equivalent of the latter is 1301·14; of barium, therefore 857·94—858·16.

STRONTIUM.

The acicular crystals obtained by crystallisation were dried at 392°, or at a red heat over the lamp. The first crystallisation generally yields too high an equivalent; on the other hand, with chloride of barium too low a one, which appears to result from a mixture of the two salts. 100 parts silver were precipitated by 73·485 and 73·471 chloride of strontium; hence the equivalent of chloride of strontium is 991·32, and that of strontium 548·02.

SILICIUM.

The chloride employed was perfectly transparent, and left no residue on evaporation in a glass dish. It had been kept for a long time over mercury. After precipitation by silver, the liquid was filtered and evaporated. A residue of transparent colorless gelatinous silica remained. 100000 silver were precipitated by 39432—39470 chloride of silicium; consequently the equivalent of the chloride of silicium = 531·95—532·28, and that of silicium = 88·75 and 88·94.

PHOSPHORUS.

Perfectly dried chlorine was passed over phosphorus until the whole had dissolved; the current was then discontinued, and a great excess of very finely divided phosphorus added. The mixture represented the protochloride mixed with a very little perchloride; after some days the liquid was decanted and shaken with tin amalgam, distilled over this tin amalgam, and rectified several times. The liquid was colorless, and did not produce any turbidness in distilled water. 100 parts of silver were precipitated by 42·74 chloride of phosphorus, hence follows the equivalent of phosphorus = 400·3.

* *Chemical Gazette*, and *Comptes Rendus*.

Arsenic.

The protochloride of arsenic was distilled several times to deprive it of the excess of chlorine. It was colorless, and disappeared in a large quantity of water; the boiling-point in the rectification remained constant at 274°—275°. The mean of three experiments was 937·50 for the equivalent of arsenic.

ON THE PRODUCTION OF COLD BY MEANS OF THE GASES.*

BY MESSRS. DE LA PROVOSTAYE AND PAUL DE SAINS.

In a former essay, which we had the honour of laying before the Academy, we undertook the study of the different circumstances that might have an influence on the cooling or heating of bodies. Without alluding to the whole of our results, we may call to mind, that in observing comparatively, the cooling of the same thermometer in places of different dimensions, we ascertained that the law, by means of which, according to Messrs. Dulong and Petit, we can connect the pressure of the air with its cooling power, gives results that differ more and more from the real phenomenon, as the size of the enclosing space goes on diminishing. In a cylinder, holding half a litre, the cooling process, under a pressure nearly the same as that of the atmosphere, is slower than in a spherical glass, holding 7 litres; it is on the contrary, considerably more rapid under low pressures. Finally, in the same cylinder, the quickness of the cooling process is the same, under the pressure of 15 millimetres, as under that of 70 millimetres, and every intermediate degree of pressure.

We thought it right to ascertain what modifications a change in the nature of the gas might produce, during the progress of the phenomenon. It is the results of these experiments, we are about to relate.

We operated with a plated thermometer, placed in a blackened cylinder, holding half a litre, and in succession, with hydrogen, carbonic acid, and protoxide of nitrogen.

EXPERIMENTS IN HYDROGEN.

In hydrogen, the time of cooling scarcely varies one twelfth of its amount, when the pressure ranges between 760 millimetres and 60; rather less than one twelfth between 60 millimetres and 20. When, also, passing the last limit, we make the pressure thirty-eight times greater, the rate of cooling varies only one seventh. If we operate in the air, and in a large enclosure, we find the total time vary in the proportion of three to one. We must also observe, that this variation is inferior to that to which the cooling power of the air is actually subjected, for by calculating the part the air itself takes in the cooling process—and it can easily be done in this case—we find it, under a pressure of 760 millimetres, five times greater than under a pressure of 20 millimetres. In hydrogen, on the contrary, and in the circumstances under which we operated, the trifling change observed in the time of cooling, represents, very nearly, that which the cooling power of the gas alone undergoes, for scarcely one eighteenth of the total heat is lost by radiation.

Above 20 millimetres, the time of cooling increases rapidly, as the pressure diminishes, it is doubled when we descend to 4 millimetres; yet still, even then, the total quickness is superior to what we observe in the open air, with a pressure of 760 millimetres, in the proportion of about 4 to 3; or if we prefer it, it is nine times greater than the quickness due to radiation. We see, then, how, under this feeble pressure, we are still distant from the march of the cooling process, as it would take place in a vacuum.

TABLE OF THE TIME TAKEN BY A THERMOMETER, TO PASS FROM 660° TO 370°, IN HYDROGEN, UNDER DIFFERENT DEGREES OF PRESSURE.

Pressures.	0m·760	0m·477	0m·57	0m·20	0m·0044
Time.	12′ 46″	13′ 20″	13′ 40″	14′ 49″	27′ 24″

EXPERIMENTS IN CARBONIC ACID.

In carbonic acid, the duration of the cooling process, increases as the pressure diminishes, until you reach about 35 millimetres. Below this point it remains constant, until you reach 12 millimetres. Finally, and this fact strongly attracted our attention, under a pressure of 4 millimetres, the process of cooling is more rapid than under a pressure

* *Comptes Rendus*, Jan. 12th, 1846.

of 35 millimetres; the difference is about one minute in twelve.

This last unexpected result, made us, in the first instance, doubt its correctness, and we did not finally admit it, until we had submitted our mode of experiments to a severe examination.

The state of the surface of the thermometer was perfectly identical, with respect to itself, when we operated under these different pressures. On one hand, in fact, numerous experiments at 35 millimetres, repeated at different times, agreed with each other; on the other hand, it often occurred to us to break off an experiment, under a pressure of 4 millimetres, began at a pressure of 12 millimetres, or 35 millimetres. The first portion of this double experiment, was always identical with the corresponding portion of a former experiment, completed at a pressure of 35 millimetres, the second, on the contrary, constantly exhibited a notable acceleration. As to the gas, we always procured it of the state of purity which proves, in a satisfactory manner, the constancy of the results obtained under the same pressure.

One only objection may, strictly speaking, offer itself to notice; the cooling process being rather more rapid in the air than in carbonic acid, we must ask whether the increased quickness observed in the last named gas, under very low pressures, is not to be attributed to the mixture of a small quantity of air, injected into the apparatus by the play of the pistons themselves. The thing in itself is scarcely probable, for an accident of this kind, irregular in its nature, would produce a want of agreement in the experiments. Besides, we operated with an excellent air-pump, and, as it may easily be imagined, we took every precaution to render the effect we dreaded impossible.

In fine, the experiments have been repeated, and the same results have been obtained by a different method, against which no objection can be raised.

The cylindrical enclosure in which we operated, could, by means of a long and narrow tube, be put in communication, at any period of the experiment, with a large cylindrical glass vessel, which had been previously filled with carbonic acid, and then emptied to about 3 millimetres. We began by allowing the thermometer to cool, under a pressure of 12 millimetres. After being satisfied, by some twenty minutes' observation, that the progress of the cooling was perfectly identical with that of a previous experiment, completed under the pressure of 12 millimetres, we brought the pressure to 4 millimetres, by opening, for a few seconds only, a small tube, which allowed the gas in the cylinder to rush into the cylindrical glass vessel. After the space of a few minutes, during which, the equilibrium in the interior was re-established, we continued the series of observations, and the acceleration manifested itself as usual.

TABLE OF THE TIME DURING WHICH THE THERMOMETER PASSED FROM 570° TO 570°, IN CARBONIC ACID, UNDER DIFFERENT PRESSURES.

Pressures.	0m·035	0m·012	0m·004
Time.	19′ 42″	19′ 38″	17′ 59″

EXPERIMENTS IN PROTOXIDE OF NITROGEN.

The densities of protoxide of nitrogen and carbonic acid are the same, their specific heat differs a little; this resemblance in their physical properties is also seen in their cooling properties; that of protoxide of nitrogen, very little surpasses that of carbonic acid. Like the latter, it remains constant, when the pressure decreases from 35 to 12 millimetres, and if it be reduced to 4 millimetres, its increase is sufficiently striking, to render its reality incontestable; it is about one twenty-fourth.

EXPERIMENTS MADE IN A MIXTURE OF AIR AND HYDROGEN.

In a mixture of equal volumes of air and hydrogen, submitted to a total pressure of 60 millimetres, the cooling process is much less rapid than in hydrogen alone, at 30 millimetres; so that the air that is added, diminishes the cooling property of the hydrogen, instead of increasing the effect it is capable of producing singly. By mixing one volume of hydrogen with seven volumes of air, we obtained a reduced rate of cooling, more considerable still.

These results are, as it appears to us, of a nature to show, that in mixtures of this kind, the gasses reciprocally influence each other, mutually modifying their mobility in such a manner, that the total effect is not the sum of the effects each gas would produce, if employed alone, at the pressure it endures in the mixture.

We shall not endeavour to give a complete explanation of the various facts noticed in this communication, we shall only observe the cooling power of a gas depends on its density and mobility. These two elements vary in an inverse ratio, when we vary the pressure, and we can understand how the effects of these contrary variations may sometimes balance each other, and at others vary in one direction or another.

…lime are extremely soluble. In …stalline in brilliant leaves, con- …Ca) O^2. As to the liquid …acid of angelica in solution, …that it is valerianic acid, with …ity of acetic acid.

…ORMATION OF FERRO- …ET OF POTASSIUM.*

…BY M. RUNGE.

…theory of M. Liebig on the …ferrocyanuret of potassium. …when mixed with one-third …converted into pure cyanuret …when calcined at a red heat, …chemist of Giessen con- …y the calcination of a mix- …d charcoal, potash, and iron, …otassium, alone, would be pro- …he ferrocyanuret would only …the solution of the product …

…o M. Runge, it is possible …ion takes place in this manner, …ate on a small scale, but in a …very different. In fact, when …olten mass in alcohol, (in an …making use of a mixture of

…lbs. of potash,
…lbs. of horn charcoal,
…lbs. of iron,

…obtain, as M. Liebig asserts, …one soluble, containing cyanu- …m, while the other, the insolu- …ould contain iron. The con- …ade.

…e the pulverised mass in a fun- …it with weak alcohol (equal …er and concentrated alcohol), …solved we obtain two liquids, …viest, is a solution of potash, …lightest, contains but a small …yanuret of potassium. But, …e black residuum with boiling …ain ferrocyanuret of potassium, …quantity as by the ordinary …

…we must conclude that the fer- …potassium (which is insoluble …already completely formed in …Besides, as it is only formed …of the aqueous solution of cy- …otassium on metallic iron, we …and how the vessels in which …which are made of sheet iron, …d, but, on the contrary, last …the fire alone injures them by …

* *Journal de Pharmacie*, Jan. 1846.

ON THE CHEMICAL COMPOSITION OF THE CALCAREOUS CORALS.

BY B. SILLIMAN, JUN.

We have been politely favoured with the following communication from the Editors of the *American Journal of Science*, and insert it with great pleasure; the article referred to appeared in vol. iv., page 458, of the *Chemist*:—

To the Editors of the Chemist.

Gentlemen—

In a number of your journal some time since, you published an article from the *American Journal of Science, &c.* on the Composition of Corals, by Mr. Dana. As some errors of importance were thus promulgated, you will, of course, be glad of an opportunity to correct them by the publication in an early number of your journal, of the enclosed article on the same subject, which we shall publish in March.

Your attention to this request, will much oblige,

Your obedient servants,

The Editors of the

American Journal of Science, &c.

pro B. Silliman, Jun.

New Haven, U. S. Jan. 20th, 1846.

This article is from the work on Zoophytes by J. D. Dana,* for which the researches were undertaken. This volume is just out of the press, but can hardly be said to have been *published*, since the small number of copies printed (only *two hundred*) will enable very few, even of those most interested, ever to see the work. The investigations have led to some unexpected results, which will be found to have an important bearing on the subject of geology; especially as serving to explain in a more rational way than any heretofore offered, the origin of those rarer ingredients in metamorphic limestones and other rocks of animal derivation, which have always been a puzzle to geologists.

No extended researches on the chemical constitution of corals have been made, it is believed, since Mr. Hatchett's, already cited by Mr. Dana. This chemist did not operate *quantitatively* on any of the species examined by him, and his investigations tended to show that the calcareous corals, as well as the coverings of most of the mollusca experimented upon, consisted merely of carbonate of lime. Such was the opinion with which these chemical examinations were commenced. But while they have found carbonate of lime to be the principal ingredient, other elements have been detected, showing that coral is far from being the simple calcareous material supposed.

The following is a list of the species examined, which are here numbered for the convenience of reference:—

1. Porites favosa, Sandwich Islands.
2. P. nigrescens, Feejees.
3. P. limosa, Feejees.
4. P. cylindrica, Feejees.
5. P. fragosa, Feejees.
6. Porites,* Paumotu.
7. Porites,* Wakes Island.
8. Porites,* Wakes Island.
9. Madrepora palmata, West Indies.
10. M. spicifera, Ceylon.
11. M. prolifera, Bermuda.
12. M. plantaginea, Ceylon.
13. M. cytherea, Tahiti.
14. Madrepora, Feejees.
15. Madrepora, Feejees.
16. Madrepora, Feejees.
17. Madrepora, Feejees.
18. M. cyclopea, Wakes Island.
19. Pocillopora damicornis, Sooloo.
20. P. elongata, Ceylon.
21. P. grandis, Feejees.
22. P. ligulata, Sandwich Islands.
23. P. cespitosa, Sandwich Islands.
24. Millepora tortuosa, Feejees.
25. Heliopora cærulea, East Indies.
26. Gemmipora brassica, Feejees.
27. Dendrophyllia nigrescens, Feejees.
28. Meandrina phrygia, Ceylon.
29. Astræa orion, Ceylon.
30. Astræa, (p. 721, pl. 13, fig. 15.)†
31. Astræa, Wakes Island.
32. Astræa, Wakes Island.
33. Astræa, Feejees.
34. Astræa, Feejees.
35. Astræa, Feejees.
36. Shell of Chama.

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* United States Exploring Expedition, during the years 1838—42, under the command of Charles Wilkes, U. S. N. Zoophytes, by James D. Dana, Geologist of the Expedition; 741 pp. 4to., with a folio atlas of 61 plates. 1846. The atlas is not yet published.

* Worn specimens, not identified.

† The references are to Mr. Dana's work.

Nine of the above species, of which there was the largest quantity on hand, were selected for a minute determination of each ingredient, while of the others, only the proportion of carbonate of lime and animal matter to the other ingredients, was determined. The following are the nine selected :—

I. Porites favosa (No. 1), Sandwich Islands.

II. Madrepora palmata (No. 9), West Indies.

III. Madrepora spicifera (No. 10), Ceylon.

IV. Madrepora prolifera (No. 11), Bermudas.

V. Madrepora plantaginea (No. 12), Ceylon.

VI. Pocillopora ligulata (No. 22), Sandwich Islands.

VII. Meandrina phrygia (No. 28), Ceylon.

VIII. Astræa orion (No. 29), Ceylon.

IX. Astræa (No. 30, p. 721, pl. 13, fig. 15).

A few remarks are added upon some of their physical characters, before giving the mode and results of analysis.

Hardness.—All the various corals examined were superior in hardness to calcareous spar or common marble, and not inferior to arragonite ; while some were as hard as apatite or crystallised phosphate of lime, or, according to the scale used by mineralogists, the usual hardness will be expressed by four, though occasionally as high as five. Using an iron mortar in the earliest trials, the iron pestle was roughened and cut under the resistance of the angular masses of coral, to a degree quite remarkable considering the nature of the substance operated on. So much iron was communicated to the powder from this source, that recourse was had to a mortar of porcelain, and even this was not proof against wear, the porcelain pestle being pitted by the repeated blows. The more porous species were crushed, of course, with less difficulty, and this was especially the case with the species of porites.

On this subject, Mr. Dana remarks, p. 711 :—"The hardness of these coral secretions, which is much above that of common carbonate of lime, as stated by Mr. Silliman, is not fully explained by the peculiar chemical composition detected by this chemist. We suggest, as one cause, that the calcareous portion may have, in its intimate texture, the structure of arragonite, or prismatic carbonate of lime, instead of that of common rhombohedral calc spar. The arragonite structure has been shown to be due to crystallisation at a higher temperature than that which is required for calc spar, the two minerals being identical in composition : in consequence of this higher temperature, a different crystalline form is assumed ; and, moreover, the material has a higher degree of hardness, that of arragonite being designated by 3½ to 4, while common calc spar or rhombohedral carbonate of lime, is 3. These remarks, it will be perceived, bear upon the internal calcareous secretions of other animals. In connexion, it should be observed, however, that distinct rhombohedrons of *calc spar* have been detected by Mr. Carpenter in the shells of some molluscæ."

Specific Gravity.—The specimens were reduced to fine powder before trying the specific gravity, as the porous character of the coral would otherwise interfere with obtaining correct results. Considerable variation will be observed in the following table. The numbers correspond to the catalogue on page 190.

Specimens.	Sp. Grav.	Specimens.	Sp. Grav.	Specimens.	Sp. Grav.
No. 1	2·817	No. 20	2·217	No. 31	2·688
3	2·732	22	2·564	33	2·500
4	2·564	23	2·353	34	2·500
9	2·421	25	2·578	Meand.rustica,	2.571
10	2·105	26	2·584	Shell of Chama,	2·857
12	2·427	27	2·740		

The average from the sixteen species of corals is, 2·523.

Color.—In general the color of the specimens examined, was white, or nearly so ; but some of them, as the Dendrophyllia nigrescens, and blue heliopora (H. cerulea) were highly colored. The coloring matter, in all cases, proved to be organic, and was usually due to some trace of the animal tissues. The highly colored ones, when powdered, burnt white, giving out, at a red heat, the odor of animal matter. The heliopora dissolved in hydrochloric acid, without having its color altered, and gave a light indigo-blue solution. A drop of nitric acid, however, discharged this color, and ammonia threw it down as a brown precipitate. Heat immediately destroys it. It is

therefore, evident that the coloring matter is entirely organic, and is in no way connected with the mineral constitution of the coral. However, some corals have a slight ferruginous tint, from the presence of a little peroxide of iron, which will be seen to be an almost constant constituent, although in exceedingly small quantity.

Behaviour with Reagents.—All corals are rapidly dissolved in dilute hydrochloric, nitric, or acetic acids, with brisk effervescence, and escape of carbonic acid. The solution is frequently colored by organic matter, which sometimes renders it turbid. When the powdered coral is treated with pure water, more or less of common salt and other soluble saline matters, derived from the evaporation of sea water, are washed out, and this precaution was found necessary to insure accurate results.

The solution of a coral in nitric acid is very soon blackened by a solution of *nitrate of silver*, from the presence of organic matter. Ammonia, added to a solution in nitric or hydrochloric acid, with the least possible excess of acid, will generally produce an immediate precipitate of granular ammonio-phosphate of magnesia, thus indicating the presence of both magnesia and phosphoric acid.

Chloride of barium produces, with a hydrochloric solution, a granular, white precipitate, which is nearly all redissolved in an excess of hydrochloric acid. (A small portion of sulphate of barytes is generally formed in using this test, owing to the almost constant presence of a small quantity of sulphate of lime in the corals).

A portion dissolved in nitric acid, and carefully neutralised, when treated with nitrate of silver, will, on standing, deposit a considerable yellowish precipitate of phosphate of silver, which is redissolved in ammonia and nitric acid.

Acetate of lead, added to a hydrochloric solution, produces a copious precipitate of chloride of lead, which is not wholly redissolved by an excess of acetic acid, but is taken up by nitric acid. These facts are a sufficient proof of the presence of phosphoric acid.

Lime-water, added to a solution of coral, either neutral or slightly acid, will produce an immediate gelatinous precipitate of all the bases and acids which the coral can contain, except, of course, the lime and solvent acid. Great care is needed in this operation to prevent the formation of a carbonate of lime; the solution should have been recently boiled, and the test applied while it is yet hot, the air being excluded; and the precipitate should be immediately collected on a filter and washed. If the precipitate by lime-water be fused in a platinum capsule, with carbonate of soda, or carbonate of potassa in excess, the phosphoric acid is all transferred to an equivalent portion of alkaline base, while the lime or magnesia, or the base with which it was before united, will remain as a carbonate. The usual tests, which have already been enumerated, will show the presence of the phosphoric acid.

The *lime-water* test, offers far the best means of separating from the lime (which exists as a carbonate) all the other constituents of a coral, as these various substances are in very small quantity, compared with the entire mass of the coral. Some easy means of completely separating them all is an indispensable preliminary step in their examination and estimation.

I am indebted to my friend Dr. J. L. Smith, of Charleston, South Carolina, for suggesting to me the use of this test in the analysis of the corals.

As the several elements, whose presence our researches have determined in corals, have been enumerated in the body of the work (p. 57), it is not necessary to repeat them here; but we may state, in a summary manner, an outline of the general course of analysis pursued in determining the constitution of the *lime-water precipitate*, which, it will be allowed, contains several elements whose association has always been considered as offering some of the most difficult problems in the whole range of inorganic analysis. The following plan of analysis has been contrived, in part from the late researches of von Rammelsberg, on the estimation of phosphoric acid, and partly from the labors of Rose and Berzelius, adapting the method to the requirements of the particular problem before us.

A. The lime-water precipitate, after ignition, is weighed, and then digested in fine powder, in cold hydrochloric acid; it slowly dissolves, leaving a white flocculent powder. This, collected and washed, will be found to be *silica*. It is harsh and gritty between the teeth; is not taken up by long digestion in strong acids; dissolves in a solution of caustic potassa; and, before the blowpipe, forms a hard colorless glass with carbonate of soda, dissolving in this reagent with effervescence.

B. The solution in hydrochloric acid, is supersaturated with caustic ammonia, and boiled; a gelatinous precipitate separates, which is usually colored by iron, and by its characters indicates the presence of alumina. This precipitate contains the phosphoric and other acids, and the bases therewith combined. It is collected, and the filtrate there-

from (C) is examined for *lime* and *magnesia*, both of which are usually present.

D. The precipitate by ammonia (B) is next made into a thick paste with strong sulphuric acid, in a small vessel of platina. A plate of glass coated with wax and written on, is placed over the crucible, and heat being applied, *hydrofluoric acid* escapes, and attacking the glass, leaves a permanent record of its presence. I have never failed to obtain evidence of the presence of fluorine in any coral which has been subjected to the test. Generally, exposure for one minute will etch the glass most decidedly, and one experiment will suffice to mark distinctly several pieces of glass. By this plan of analysis, the quantity of fluorine cannot be estimated, and it must be judged of, either by the loss or by the deficiency of acids, to satisfy all the bases formed. The constant association of phosphoric acid and fluorine, renders it advisable, in compounds in nature, where one of these elements is found, to search for the other.

E. After the sulphuric acid has been digested on (D) long enough to convert all the bases present into sulphates, a portion of bisulphate of potash, or caustic potash, is added, and a little water, to dissolve it; to this a very large quantity of alcohol, of a specific gravity of about ·860, is added, and the whole is allowed to stand for some hours; during which the double sulphates of potassa, alumina and iron, crystallise out, while any lime previously combined, is separated as sulphate; and in the solution we must look for the phosphoric acid and magnesia, together with a little persalt of iron, held up by the alcohol.

F. The mixture (E) being filtered, and the precipitate washed quite clean with alcohol, the filtrate is evaporated until all the alcohol is expelled, and then supersaturated with ammonia; a little trace of alumina and iron separates, which may be added to that to be obtained from the other portion (H). We may now either add an excess of pure chloride of calcium to the filtrate (F), or a portion of perchloride of iron. The object in either case, is to separate the phosphoric acid in combination with a base, from whose weight its quantity may be directly estimated, which is an indispensable step, since the fluorine, according to this plan of analysis, can be estimated only by the amount required to saturate the excess of bases. In case the chloride of calcium is employed, we have all the phosphoric acid in the form of phosphate of lime, mixed with a large quantity of sulphate of lime, derived from the sulphuric acid, and sulphate of potassa previously employed. This mixture of phosphate and sulphate of lime is collected, washed, and redissolved in hydrochloric acid. The sulphate of lime is separated by alcohol, and the phosphoric acid remains in solution, which, after the excess of alcohol has been expelled, may be thrown down by ammonia, ignited, and weighed, or preferably, may be estimated by a magnesian salt. If we employ the method by perchloride of iron, we form in the acid solution containing the phosphoric acid, a basic perphosphate of iron, on supersaturating the solution with ammonia. This compound is mixed with a bulky mass of peroxide of iron, which, being thrown on a filter and thoroughly washed, is subsequently decomposed completely, by hydrosulphuret of ammonia, into sulphuret of iron, and phosphate of ammonia. Care must be taken to use a sufficient quantity of perchloride of iron, otherwise a white precipitate of neutral perphosphate of iron is formed, which is soluble in an excess of ammonia. In either case (the employment of the chloride of calcium or the perchloride of iron) the phosphoric acid eliminated may be finally best estimated by a magnesian salt and ammonia, as the ammonia-phosphate of magnesia, from whose known constitution the phosphoric acid is easily calculated. We have employed both of these methods, but on many accounts prefer that by the perchloride of iron.

G. The alcoholic filtrate from (F), containing magnesia and lime, is treated by the well known methods of analysis, for the estimation of those substances. The lime in all cases, in these researches, was converted into sulphate, and precipitated by alcohol. The magnesia was estimated as phosphate.

H. The crystalline precipitate from (F), which was collected on the filter, contained the alumina and iron, previously in combination with phosphoric acid or fluorine. This precipitate is boiled in a capsule with a strong solution of carbonate of soda, to decompose the sulphate of lime; it is then filtered, the insoluble residue washed thoroughly, and treated with hydrochloric acid, the precipitate by ammonia from (F) being added, and the whole treated with excess of ammonia. Alumina and iron fall, which may be afterward separated in the usual way; but this was, generally, not deemed requisite, the quantity of iron being very small in most cases.

I. The filtrate from (H) is treated for lime by oxalate of ammonia, and the oxalate converted into sulphate and weighed; this dose of lime had been previously united to phosphoric acid or fluorine.

J. Magnesia is next separated from the filtrate of (I), by ammonia and phosphate of soda.

K. The alkaline liquor from (H) contains another portion of magnesia, which is separated in like manner as the ammonio-phosphate. Much labour is saved if we take care to reserve the several portions from which magnesia has been thrown down, and unite them in one filtration and weighing, instead of treating them as so many separate portions.

The minute determination of all the constituents of the lime-water precipitate, was attempted only on those specimens of which we had a large quantity at command; for a solution of half a pound or more of the coral in nitric or hydrochloric acid, was necessary to afford sufficient precipitate for analysis. The carbonate of lime, by far the most abundant constituent, was separately determined on one gramme, as sulphate of lime, and from this the carbonate was calculated. The ratio of phosphates and fluorides of the several bases to the entire mass, was also determined from a distinct portion of coral, two grammes by weight; and from the data thus furnished, we have the means of safely estimating the organic matter by the loss.

Organic Matter.—This constituent of the corals deserves particular notice. Some remarks have already been made on it, when speaking of the coloring matter of corals. This organic matter is so intimately united throughout the whole structure of the corals, amounting from 4 to 8 per cent., that it cannot be separated by any method resorted to, except by repeated deflagrations with the nitrate of ammonia. When reduced to the finest impalpable powder, it may be digested in repeated doses of boiling water, until no trace of organic matter is longer found in the water; and yet a careful analysis, by falling short of the amount required to complete the 100 parts, will invariably show its presence. The oxalate of lime obtained in their analysis, if ignited, (as in the usual manner directed for the estimation of lime,) will always have a dark carbonaceous hue, derived from the organic matter of the coral.

During the solution of considerable quantities of several corals, whose analyses are given beyond (particularly in No. IV., but more or less in all), a large quantity of fatty (?) matter separated, of a yellow color and disagreeable penetrating odour, though not fetid. It was easily seen floating on the surface of the solution, in transparent jelly-like masses of a yellowish color. It was insoluble in alcohol, but readily so in cold ether, and the evaporation of its ethereal solution yielded a yellow solid, resembling wax. It fuses below 200°F. A pungent irritating odour arose from the evaporation of the ethereal solution near its close, which acted powerfully on the eyes and nostrils. This volatile principle may be analogous to that known to proceed from the decomposition of fat (acrolein?). It deserves more attention than I have been able to give it, particularly as it may perhaps be the source of the disagreeable odour of some limestones of coral origin.

Analyses.—The following tables exhibit a comprehensive view of the results of the several analyses. The relative proportions of organic matter, carbonate of lime, and the complex precipitate of phosphates and fluorides thrown down by lime-water, are first given; and afterwards the definite composition of this precipitate in the nine species more minutely investigated.

	Porites. No. 1. (I).	Porites. No. 3.	Porites. No. 4.	Porites. No. 5.	Porites. No. 6.
Carbonate of lime	95·84	94·412	94·807	93·875	89·164
Phosphates and fluorides	2·05	0·900	0·950	1·561	0·700
Organic matter	2·11	4·688	4·243	4·564	9·431

	Porites. No. 7.	Porites. No. 8.	Madrepora. No. 9 (II).	Madrepora. No. 10 (III).	Madrepora. No. 11 (IV).
Carbonate of lime	94·438	95·000	94·807	92·815	95·086
Phosphates and fluorides	2·100	1·650	0·745	0·600	0·300
Organic matter	3·462	3·350	4·448	6·585	4·614

	Madrepora. No. 12 (V).	Madrepora. No. 14.	Madrepora. No. 15.	Madrepora. No. 16.	Madrepora. No. 17.
Carbonate of lime	94·881	93·297	94·143	94·239	93·59
Phosphates and fluorides	0·710	2·450	0·900	0·500	0·50
Organic matter	4·409	4·253	4·957	5·261	5·91

	Pocillopora. No. 19.	Pocillopora. No. 20.	Pocillopora. No. 21.	Pocillopora. No. 22 (VI).	Pocillopora. No. 23.
Carbonate of lime	94·659	93·60	95·001	93·848	94·583
Phosphates and fluorides	0·550	1·90	1·450	0·550	1·050
Organic matter	4·791	4·50	3·549	5·602	4·397

	Millepora. No. 24.	Heliopora. No. 25.	Gemmipora. No. 26.	Meandrina. No. 28 (VII).	Astræa. No. 29(VIII).
Carbonate of lime	94·226	95·545	92·751	93·559	96·471
Phosphates and fluorides	1·200	1·000	1·500	0·910	0·802
Organic matter	4·574	3·455	5·749	5·536	2·727

	Astræa. No. 30 (IX).	Astræa. No. 31.	Astræa. No. 33.	Astræa. No. 34.	Astræa. No. 35.
Carbonate of lime	96·551	94·810	91·782	93·923	91·112
Phosphates and fluorides	0·262	0·900	2·100	0·500	0·550
Organic matter	3·187	4·290	6·118	5·577	8·338

A portion of the massive shell of a large ohama, treated in a similar manner, afforded for 100 parts the following result:—

Carbonate of lime ..... 97·007
Precipitate by lime-water .... 2·600
Organic matter ..... 0·398

The amount of organic matter is here very small; while the precipitate by lime-water is large. The examination of other shells with reference to this point, would have been highly interesting, and, had it fallen within the scope of these researches, the subject would have been further investigated.

The per-centage of phosphates and fluorides in the above analysis, after excluding the organic matter, is as follows:—

Specimens.	Phosphates and Fluorides.	Specimens.	Phosphates and Fluorides.	Specimens.	Phosphates and Fluorides.
No. 1 (I)	2·095	No. 12 (V)	0·743	No. 24	1·258
3	0·945	14	2·562	25	1·036
4	0·992	15	0·947	26	1·593
5	1·637	16	0·528	28 (VII)	0·964
6	0·774	17	0·537	29 (VIII)	0·825
7	2·177	19	0·578	30 (IX)	0·270
8	1·710	20	1·990	31	1·040
9 (II)	0·780	21	1·504	33	2·114
10 (III)	0·642	22 (VI)	0·583	34	0·529
11 (IV)	0·314	23	1·099	35	0·600

It now remains to give the constitution of the precipitate of fluorides and phosphates. The results annexed are calculated for a hundred parts of the precipitate.

	I.	II.	III.	IV.	V.
Silica	22·00	12·5	13·50	10·32	23·74
Lime	13·03	7·5	10·40	15·57	35·01
Magnesia	7·66	4·2	1·63	38·49	1·35
Fluoride of calcium	7·83	26·34	34·85	7·50	8·88
Fluoride of magnesium	12·48	26·62	19·06	2·62	20·44
Phosphate of magnesia	2·70	8·00	5·87	0·25	3·46
Alumina (and iron)	16·00	14·84	14·69	25·25	7·12
Oxide of iron	18·36				

	VI.	VII.	VIII.	IX.
Silica	5·35	11·0	30·01	8·70
Lime	7·17	25·9	17·45	16·74
Magnesia	0·49	0·8	24·47	45·19
Fluoride of calcium	4·05	15·0	0·85	0·71
Fluoride of magnesium { Phosphate of lime, }	4·25	{ Fluoride of mag. } 23·2	4·31	2·34
Phosphate of magnesia	16·30	4·7	0·32	0·34
Alumina (and iron)	35·00	19·4	22·49	25·79
Oxide of iron	27·39			

The foregoing results show that, contrary to the expectation when the research was commenced, the fluorine is present in much larger proportion than phosphoric acid. The silica exists in the coral in its soluble modification, and probably is united to the lime. The free magnesia existed as carbonate, and was thrown down as caustic magnesia by the lime-water. Some small portion of lime was probably thrown down as carbonate, in spite of every precaution to the contrary. Only in two or three instances, however, was there any effervescence on the addition of hydrochloric acid to redissolve it.

It need hardly be said that the existence in sea water of all the matters noted in these analyses, is a just inference; but this subject, as well as the important geological inferences which may be drawn from the results now presented, will be fully discussed on another occasion.

My warmest acknowledgments are due to my friends and pupils, Messrs. D. Olmsted, Jun. and T. S. Hunt, who have zealously aided me in the laborious parts of these investigations.

Yale College Laboratory,
Dec. 16, 1846.

A TEST FOR SULPHUROUS ACID.*

BY M. W. HEINTZ.

The following is a very characteristic reaction, recommended by M. Heintz, for discovering the least trace of sulphurous acid; the substance to be examined being dissolved in water, or hydrochloric acid, is heated until the liquid boils, along with a solution of perchloride of tin, in dilute hydrochloric acid. If the liquid contains much sulphurous acid, sulphuret of tin is precipitated; but, if the sulphurous acid is in very small quantity, there is no precipitation, the liquid is but slightly tinged with yellow, and it acquires the smell of sulphuretted hydrogen; it is then sufficient to add a few drops of sulphate of copper, to obtain, immediately, a brown precipitate of the sulphuret of that metal.

This mode of discovering sulphurous acid is, as we see, merely a modification of that recorded more than fifty years ago, by Pellitier, and recommended since his time by M. Girardin.

It is preferable to that of Messrs. Fordos and Gelis, which is based on the formation of sulphuretted hydrogen, by the contact of metallic zinc and sulphurous acid gas, as it renders unnecessary the employment of an apparatus to disengage the gas.

*Jour. de Pharmacie, Jan. 1846.

ACTION OF CHLORINE ON THE OXALIC ETHER OF ALCOHOL. AND ON THE ACETATE OF METHYLINE.*

BY S. CLOEZ.

A preparatory examination of chlorated acetic ether, which I intended for the preparation of chloracitemide, enabled me to discover in this liquid properties differing from those attributed to it by M. Leblanc; I cannot positively say what is the reason of the difference of my results from those of that chemist, perhaps it arises from the mode of operation not being the same.

I remarked that the boiling point of the liquid when distilled, for the first time, in a stream of dry carbonic gas, to remove the excess of chlorine and hydrochloric acid, was raised from 221° to 336° F. I then thought I was dealing with a compound substance. To satisfy myself I again distilled it, preventing, as much as possible, the excess of moisture: about one half of the liquid passed over between 221° and 248°, it was collected and set aside, the part distilled between 266° and 356° was also set aside, as well as that whose boiling point rose to from 356° to 518°. Each of these products was analysed separately, and I observed that, as the boiling point became higher there was a greater proportion of carbon and hydrogen, while the amount of chlorine diminished. My experiments proved that the portion containing the largest amount of chlorine did not condense like acetic ether. Its molecules become separated, a disintegration takes place, and a chlorated aldehyd is formed. There is nothing astonishing in this result, it exactly resembles that obtained by M. Chenault, in the case of perchlorated methylic ether.

As the liquids boil at a temperature above 248°, they ought to be considered as compounds of chlorated aldehyd, a small quantity of acetic ether, and 7 equivalents of chlorine.

To remove all my doubts as to the nature of the most volatile of the liquids, I ascertained the density of its vapour. The number I obtained was not precisely that given by calculation, but it was very nearly so; the difference must be attributed to the extreme difficulty that exists of preventing the substance undergoing a slight change.

The following are the results:—

Temperature of the air	63°·05
Temperature of the vapour ..	410°·0F.
Excess of weight of the vapour	0·900
Capacity of the glass globe..	0·197 cent.
Barometer	0·761 mill.
Remaining air	0·002 cent

* Jour. de Pharmacie, Jan. 1846.

From whence we deduce—	
Weight of the litre	9·773
Density of the vapors	7·52
By calculation, we obtain—	
4 volumes carbon.....	3·368
8 ,, chlorine	19·522
2 ,, oxygen	2·210
Calculated density	25·100 = 6·28
	4

The liquid examined has, in other respects, all the properties of perchlorated aldehyd, when exposed to the air. It gives out white vapours of a suffocating odour, moisture decomposes it at the end of a short time. it yields beautiful crystals of chloracetic acid, and immediately forms chloracitamide, when placed in contact with ammonia.

PERCHLORATED ACETATE OF METHYLINE.

The action of chlorine on the acetic ether of wood-spirit, was in more than one respect an interesting subject to examine; this liquid has exactly the same composition as the formic ether of alcohol, their physical properties are clearly the same, but their chemical properties differ essentially; their decomposition under the influence of the alkalies, sufficiently characterise them. I wished to ascertain whether the differences observable in their chemical properties to be met with in the products derived from these ethers, under the influence of chlorine.

Perchloroformic ether, being constant in its composition, and exhibiting well-marked re-actions, I endeavoured to obtain an analogous compound with acetate of methyline. The chlorate compound I obtained had precisely the same composition as perchloroformic ether, and in addition, the same physical and chemical properties: thus it issues at the temperature of nearly 592°F., when we cause the vapour to pass along a porcelain tube, made nearly red hot, as M. Malagutti did in the case of several chlorated ethers, it is decomposed into chlorated aldehyd, and chloroxicarbonic acid; its density, at 66°, is equal to 1·691, and it is decomposed by moisture into chloracetic, hydrochloric, and carbonic acids; with mineral alkalies it yields a chloracetate, a chloride, and a carbonate; with ammonia it instantly forms chloracetamide, and there is an elimination of hydrochloric gas and carbonic acid, which remain united with ammonia. Placed in contact with alcohol it is decomposed, in the same manner as perchloroformic ether, and hydrochloric, chloracetic, and chloroformic ethers are formed,* the latter has been improperly called chloroxicarbonic ether.

Perchloroformic Alcohl. Chloracetic
ether. ether.

$$C^6Cl^6O^4 + 2(C^4H^6O^2) = C^4Cl^3O^3C^4,H^5O +$$

Chloformic ether.

$$\{C^2ClO^3,C^4H^5O + 2(HCl).$$

Wood-spirit comports itself in the same manner.

The chloracetic and chloroformic ethers of alcohol or wood-spirit, obtained in this manner are mingled, and it would be difficult to separate them, but they are easily recognised by the products they yield with ammonia; in that case we have chloracetamide, and urethane or urethylane. This new mode of preparing these two last substances has to be added to those already known, and it may be utilitised in the end.

We may, without having recourse to any hypothesis, relying only on facts, admit the identity of the final product of the action of chlorine on the acetate of methyline, with that obtained by the action of the same agent on the formic ether of alcohol.

If the identity I admit, be real, the consequences that naturally flow from it are interesting, in a theoretical point of view, inasmuch as they relate to the question of the existence of chemical types, and to the preservation of those types in what are called the products arising from substitution.

In whatever manner we regard the constitution of ethers, we always ought, under the hypothesis of the existence of types, to obtain by the action of chlorine, compound derivatives having the same molecular arrangement as the substance from which they arose. Consequently, perchlorated formic ether would always possess a molecular constitution, differing from that of the perchlorated acetate of methyline, and, if the type is preserved, these

* The preparation of the chloroformic ether of alcohol or wood-spirit, by means of chloroxicarbonic acid, is a long and difficult operation, it is probable that the perchloroformic of methyline might be employed with advantage in the preparation of these compounds. It would be sufficient to treat it, either with alcohol or wood-spirit: with alcohol we should have the following reaction:—

Perchlorated formo- methylic ether. Alcohol.

$$C^4Cl^4O^4 + 2(C^4H^6O^2) =$$

Chloroformic ether. Hydrochloric acid.

$$2(C^2ClO^3C^4H^5O) + 2(HCl).$$

Wood-spirit produces a reaction exactly resembling this.

I hope I shall be able shortly to make an experiment to ascertain whether formomethylic ether, when submitted to the action of chlorine, will not be disintegrated, so as to yield a final product of chloroxicarbonic gas alone.

liquids ought to offer different reactions; but we have seen that the contrary is the case.

The nature of the final product of the action of chlorine on acetic ether is, also, according to my observations, contrary to the opinion of the existence and preservation of a type; it is evident that the chlorated aldehyd, $C^4Cl^4O^2$, which I obtained in this manner, could not possess the molecular grouping of the acetates.

On the other hand, the production of chloracetamide, by means of chlorated formic ether, is not, it must be acknowledged, any greater argument in favor of the same opinion. It is a fact, that would have no signification, if it was isolated; but, joined to those that precede it, it ought, as it appears to me, to possess great value.

Identity in the derivatives of two isomerous bodies, being differently constituted under the influence of the same agent, whatever may be the case in other respects, has nothing surprising in it; science possesses many facts of a like nature, the experiments of M. Regnault on chlorated ethers furnish a remarkable example.

The Dutch liqueur, C^4H^2ClHCl, is isomerous with monochloruretted hydrochloric ether, $C^4H^4Cl^2$, but the action of potash on these bodies essentially distinguishes them, and points out a different constitution, still, however, under the influence of chlorine they are both finally changed into an identical product, which is the chloride of carbon, C^4Cl^6.

From all these facts we may conclude that the admission of chemical types, which necessarily implies their preservation in products derived by substitution, is but a simple hypothesis, and does not constitute a general theory, as the recent writings of several chemists have a tendency to admit.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

IMPROVEMENTS IN THE MODE OF TREATING FARINACEOUS SUBSTANCES.*

BY JAMES FRANCIS PINEL.

This invention consists in the preparation of all kinds of flour (but especially the fecula of potatoes) by means of acids, in order to obtain a certain gum, which may be employed as a substitute for gum tragacanth, senegal, and similar gums, generally used for dressing, stiffening, glazing, sizing, dyeing, printing and finishing calicoes, nets, crapes, laces, silks, papers, and all goods or fabrics of a similar kind.

The mode of manufacturing the gum is as follows:—half a gallon of nitric acid and half a pint of hydrochloric acid are mixed with 100 gallons of spring water, and then as much flour or fecula as will be sufficient to form a paste being added, the whole is well-worked together, and left for two hours to settle; after the expiration of this time, the paste is carefully removed into buckets properly prepared for allowing the water to drain off. When sufficiently drained, the paste is divided into small lumps, which are placed on shelves in a drying-room, and allowed to remain until perfectly dry; the dried paste is reduced to powder and placed on shelves in a stove, the temperature of which is raised, on the first day, to 100° F., on the second day to 150°, and on the third day to 190°. After this drying process the powder is allowed to cool, and is passed through a sieve; it is then placed in an oven, the heat of which is raised to from 300° to 350° F., and when thoroughly baked it will be ready for use. The operator can ascertain if the process has been correctly carried out by mixing a small quantity of the powder with some filtered water, in which it should readily dissolve, without leaving any sediment.

To produce the above gum in lumps, resembling natural gum, both in colour and transparency, the patentee mixes the powder, after it has gone through the stove, and been sifted, with as much water as will reduce it to a paste, adding 1 part of nitric acid to 400 parts of water. When well mixed, the paste is spread upon copper dishes, in layers three quarters of an inch deep, and placed in an oven heated from 240° to 300° F.; as soon as it has become sufficiently hard, it is removed from the oven into the open air, and when cool is ready for use.

If the flour or fecula is gray—that is, if it has been badly prepared and adulterated, or damaged, the patentee uses, instead of the hydrochloric acid, half a pint of sulphuric acid, by the agency of which, the heterogeneous substances are separated from the good flour. The mode of operating is, in other respects, the same as before.

* *Chem. Gazette.*

ON A METHOD OF PREVENTING SALINE INCRUSTATION IN STEAM BOILERS.*

BY DR. RITTERBANDT.

SOME experiments have been lately tried, at Portsmouth, on the method proposed by Dr. Ritterbandt for preventing the deposit of saline matter by the evaporation of water. The plans hitherto pursued have been chiefly directed to the collection and separation of the saline matter, as it is deposited; but Dr. Ritterbandt has proposed to substitute a salt, capable of converting the insoluble carbonate of lime into soluble chloride of calcium. This salt is the muriate of ammonia, or, as it is called in the patent, the chloride of ammonium. We extract the following account from a report lately published:—

"One of the greatest difficulties with which engineers have to contend in the application of steam, is the incrustation of the boiler, producing not only a great expenditure of fuel, but often fatal explosions, especially in tubular boilers, as their peculiar form almost entirely prevents scaling or the application of other mechanical remedies. The experiments with the muriate of ammonia have been eminently successful in its application to the boilers of the 'Echo,' under the superintendence of the patentee. The substance does not discolor the water, nor communicate to it any unpleasant taste or smell; it has no injurious effect upon the metal of the boiler; does not increase the density of the water—therefore does not produce 'priming;' nor does its application involve any alteration in the boilers now in general use. The action of the chloride of ammonium is, to change the carbonate of lime into chloride of calcium, which is not deposited by heat; and as the crystallisation of other salts, such as the sulphate of lime, depends, in a great measure, upon contact, the absence of nuclei of solid carbonate prevents, in a great measure, their formation. In marine boilers this is very evident; for, after adding chloride of ammonium, and thus preventing the precipitation of insoluble carbonate of lime, it is almost impossible to obtain crystals of common salt; thus 'blowing off' is rendered almost unnecessary, in proof of which the 'George IV.' commercial steamer, plying between this port and Southampton, worked twelve days without blowing off, by merely using a small quantity of the material every day; nor when the boiler was afterwards examined was there any exhibition of a tendency to deposit."

* *London Medical Gazette.*

Remarks.—Having repeated Dr. Ritterbandt's experiments, we are enabled to say, that so far as relates to the carbonate of lime, which forms a very large proportion of these deposits in most kinds of water, the results were most satisfactory. The quantity of muriate of ammonia required to prevent precipitation, on boiling, was exceedingly small, certainly insufficient to affect materially the properties of the water, or to act on the metal in which the evaporation was carried on. Three ounces of an artificial calcareous water—prepared by passing carbonic acid into lime-water until the carbonate of lime was suspended—gave no deposit of carbonate of lime when boiled with one grain of muriate of ammonia. The same water became speedily turbid on boiling, when no muriate of ammonia was added to it. The liquid holding the muriate dissolved, remained quite clear, and the application of tests showed that ammonia, as well as carbonic acid, escaped during ebullition, while chloride of calcium was formed. The known equivalents of the bodies show that for every grain of carbonate of lime held dissolved in the water, rather more than one grain of muriate of ammonia will be required to effect this transformation. A gallon of the water of the Thames, yielded about eight grains of carbonate of lime. About eight grains of muriate of ammonia would, therefore, suffice to prevent any precipitation of carbonate by mere boiling. If too much muriate of ammonia be employed, there will be some muriatic acid set free, since the ammoniacal salt invariably loses a portion of its base on boiling. The quantity of muriate of ammonia, required to prevent deposit in any particular water, may thus be tested; for, after boiling, there should be no deposit, and the liquid should not be reddened on the addition of blue infusion of litmus, the resulting chloride of calcium not being decomposed at 212°.

The sulphate of lime and common salt are, it is well known, deposited owing to the loss of water required for their solution; the presence or absence of carbonic acid in the water does not affect them. We are, therefore, inclined to doubt how far the new method will operate, as it is alleged, in preventing the deposit of these salts. The chloride of calcium may render them more soluble, but it appears to us that the large evaporation of water, must ultimately lead to their forming an incrustation in the boiler.

The new process may, perhaps, be applied to domestic use where the spring water is particularly hard. The chloride of calcium would thus be substituted in dietetic use for carbonate of lime. It remains to be seen

whether this substitution in a very small degree would affect the health.

We have applied the new process to water containing phosphate of lime, and with equal success. This salt is not a constituent of sea or common spring water, but it has been found by Prof. Graham in the water which issues from deep wells in the chalk basin of London. Phosphate of lime, like the carbonate, is suspended or dissolved in water by the excess of carbonic acid contained in it. If the phosphatic water be boiled it is rendered turbid, and the phosphate is deposited. If muriate of ammonia be added before boiling, the liquid remains clear, but more muriate of ammonia is required for the purpose, than in the case of carbonate of lime. In this instance, the ammonia is evolved with the carbonic acid; and the muriatic acid, set free, suspends the phosphate. Such water is, therefore, always acid, and may affect the metallic vessels in which it is boiled. Although the discovery of Dr. Ritterbandt may not have all the beneficial results which he and his friends have anticipated from it, it nevertheless removes one part of the evil, and he undoubtedly deserves credit for this new and ingenious application of chemical science.

DETERMINATION OF THE AMOUNT OF AMMONIA CONTAINED IN THE ATMOSPHERE.*

BY A. GRÆGER.

ALTHOUGH the existence of ammonia in atmospheric air can no longer be doubted, yet it is important to have a direct proof of it and to determine its quantity. The amount of ammonia in the air at various places, for instance, in large towns, has probably some influence on the health; and a careful inquiry into these relations, would certainly add much to our knowledge of the origin of diseases of the lungs. The author recommends, for the above purpose, Mohr's apparatus, connected with a thin cylindrical vessel containing dilute muriatic acid.

To obtain, in the first place, an expression for the minimum of the amount of carbonate of ammonia in the air, the first experiment was made on rainy days, between the 14th and 17th of May last year, when it might be supposed that the greater portion of the ammonia had been removed by the rain.

After the author had allowed 36 cubic feet of air, at 744·97mm B. and 51° F., to pass slowly through the muriatic acid, the acid liquid was evaporated in the water-bath in a small platinum dish with a solution of chloride of platinum; the residue was extracted with a mixture of alcohol and ether, the insoluble residue collected on a filter, washed, dried and weighed. The author obtained in this way 0·006 grm. ammonio-chloride of platinum = 0·0008466 grm. carbonate of ammonia. Since 36 cubic feet = 1 112 cubic metre at 744·97mm barometric pressure and 51° F. = 1·06 cubic metre at 32° F., it hence results, that under the above conditions 1·000000 part air contains 0·6148 grm., or somewhat more than $\frac{3}{4}$ millionth of carbonate of ammonia.

The author subsequently repeated the experiment during constant dry warm weather, and obtained nearly the same results.

* *Chemical Gazette.*

EXAMINATION OF A PREPARATION FOR DYEING THE HAIR.*

BY A. CHEVALIER.

THE examination we have made of this preparation has demonstrated to us that it is composed, 1st, of a liquid portion; 2nd, of a solid portion. The liquid portion consists of oxide of lead, dissolved by lime, which has re-acted on the metallic oxide. The solid part is composed of oxide of lead and caustic lime.

To prepare these two products—one, liquid, to dye the hair; and the other, solid, from which the liquid that dyes the hair is prepared—we take, 1st, 20 grammes of quick-lime in powder, which is obtained by steeping a lump of lime in water until it will absorb no more, and then leaving it exposed to the air; the lime soon swells, bursts, and furnishes a white powder more or less fine, according to the goodness of the lime. We take 20 grammes of this powder and mix it with 50 grammes of water: it is very carefully mingled, and passed through an extremely fine silk sieve. We introduce the milk of lime, the white matter that has passed through the sieve, into a flask holding about 125 grammes.

2. We take 20 grammes of acetate of lead, and dissolve them in a sufficient quantity of water; we add to the liquid thus obtained, caustic lime, in sufficient quantity to saturate the acetic acid of the acetate. We then obtain a white precipitate of hydrated oxide of lead, and we allow it to settle; pour off the supernatant liquid, and wash the oxide of lead (the white precipitate) several times with water: when it is well washed we mix it with the milk of lime. These two products mixed together form the preparation we have examined.

* *Jour. de Chimie*, Feb. 1846.

IMPROVEMENTS IN THE PREPARATION AND APPLICATION OF VARIOUS FARINACEOUS PRODUCTS; AND OF MACHINERY USED IN MANUFACTURING THE SAME.*

BY JAMES THOMPSON.

THIS invention consists in improvements in preparing flour and other products from potatoes, and in the machinery for manufacturing the same.

The potatoes are steeped in water for five or six hours, and then thrown into a cylinder (composed of a number of wooden bars, an inch or two apart), revolving in a trough filled with water. By the revolution of the cylinder, the potatoes are freed from dirt, and from the greater portion of their skins; the dirty water runs off through an outlet in the bottom of the trough, while a continuous supply of clean water is kept up from a pipe overhead. After this, the potatoes are reduced, by rasping, to a fine pulp, the fibrine contained in which is then separated from the starch, by subjecting it to a number of washings in cylindrical sieves of metallic gauze; the starch passes through the sieves in solution, and the fibrine, or the greater portion thereof, remains in the sieves. Common salt is added to the starch liquor, in the proportion of about one ounce to each gallon of the liquor, which has the effect of throwing up any small particles of fibrine that may not have been separated by the preceding operation; and from the purified starch liquor a fine flour is obtained, by subsidence, re-washing, drying, sifting, &c. as practised by manufacturers of potato starch. The fibrine is converted into yeast, by first subjecting it to great pressure, to expel the water; it is then dried, and ground into meal; this meal is mixed with a decoction of hops, and the mixture is strained and left for a short time to ferment, when it becomes converted into yeast, suitable for baking and other fermenting purposes.

The potato flour is used for improving the quality of bread, by adding to the liquor used in making the dough, about one or two pounds of the potato flour for each sack of wheat flour employed; or the potato flour may be made into a jelly with boiling water, and worked up with the dough,—this addition causes the bread to keep sweet and moist much longer than usual, and prevents it from crumbling. Potato flour is also mixed with the ingredients used in making pastry, in about the same proportion as for bread; and it causes the article so made to be much lighter than usual. A fancy cake may be made with potato flour alone, and without butter, by beating up the yolk of eggs with sugar, thickening with potato flour, flavouring with citron or lemon, and then baking it.

The patentee claims, firstly, the washing and peeling of potatoes by means of an open-ribbed cylinder, revolving in water, as above described; secondly, the preparation, in the manner above described, of the fibrine of the potatoes, after its separation from the starch, and its application to the manufacture of yeast; thirdly, the application of potato flour, prepared as aforesaid, to the improvement of bread and pastry.

* *Newton's London Journal.*

IMPROVEMENTS IN THE MANUFACTURE OF ALUM, AND OF ALUMINOUS COMPOUNDS, FROM A SUBSTANCE NOT HITHERTO USED FOR THAT PURPOSE, AND IN THE PRODUCTION OF AN IMPROVED FIRE-CLAY FROM THE RESIDUUM THEREOF.*

BY JOSEPH CLIFF.

THIS invention relates to such fire-clays as contain a great quantity of alumina, especially the "Wortley fire-clay." The improvement consists in extracting the whole or the greater part of the alumina therefrom, and converting it into alum and aluminous compounds, and in using the purified clay, either alone or combined with other fire-clay, for making fire-bricks, glass-house pots, crucibles, gas retorts, and similar articles.

The Wortley fire-clay, or any other fire-clay containing alumina in excess, is first ground, then calcined, and afterwards submitted to the action of sulphuric, nitric, muriatic, or other acid, more or less diluted with water, and with or without the assistance of heat. The mass being lixiviated with water, the alumina is obtained in solution, and this solution is freed from iron by the employment of prussiate of potash, gallic acid, sulphuretted hydrogen, or some other suitable agent. The patentee now either evaporates the solution by itself, to get the sulphate, nitrate, or muriate of alumina, according to the acid used; or he mixes the sulphate or muriate of potash, soda, or ammonia, with the solution, and evaporates and crystallises the same, to obtain the alum salts, and then, by roaching, the alum of commerce is formed. After the whole or the greater part of the alumina has

* *Newton's London Journal.*

been extracted, as before described, the purified and residuary earth may be employed, alone, or combined with other clay, in the manufacture of fire-bricks, glass-house pots, crucibles, gas retorts, and similar articles.

The patentee claims, firstly, the extraction from fire-clays of the whole or part of the alumina contained therein, previous to the application thereof to the making of fire-bricks and other like fire-resisting articles. Secondly, the manufacture of alum and aluminous compounds from the Wortley fire-clay, before mentioned, or any other fire-clay containing alumina in similar abundance. Thirdly, the application of the residuum of such fire-clay, by itself, or in combination, in any proportion, with Wortley or any other fire-clay in its native state, to the making of fire-bricks, glass-house pots, crucibles, gas retorts, and other like articles.

EXPERIMENTS ON THE AVOIDANCE OF LIGHT BY THE ROOTS OF PLANTS.*

BY M. DURAND.

UNTIL the present day, the avoidance of light by the roots of plants has only been observed in three instances, first, in the root of *Pothos digitata*, noticed by M. Dutrochet; second, in the roots of the cabbage and white mustard by M. Payen. The latter says, that many other roots present the same phenomena, but he does not give the names of any of these plants, so that in the presence of this vague assertion, fresh inquiries for the same purpose were still of considerable interest. Pursuing this subject, M. Durand has established the fact that the roots of the following plants avoid the light:—

Raphanus sativus (radish)
Cheiranthus incanus (stock)
Myagrum sativum
Isatis tinctoria (woad)
Diplotaxis tenuifolius
Erysimum contortum
Synapis levigata
Alyssum vesicatoria
Brassica napus (turnip)
Brassica campestris (colewot)
Brassica orientalis
The secondary roots of Lathyrus odoratus
The roots of several varieties of Brassica oleacea

M. Durand performed his experiments by placing the roots of the plants in glass vessels, the interior of which were covered with black cloth, or painted black, on two-thirds of the side opposite that from which the light proceeded, so that the roots received no sensible quantity of light from the blackened side, he perceived that the roots of *Lepidium sativum*, which had been represented as not bending under the influence of light, did really avoid it.

The root of one plant alone, that of *Mirabilis jalappa*, was represented by M. Dutrochet as bending towards the light, and as the spongioles of this root contains a green substance, this peculiarity of organisation was considered by him as the cause of its inclination towards the light. M. Durand discovered another plant, the roots of which bent towards the light; this plant is the common onion, *Allium cepa*. He proved also, that the spongioles of the roots of this plant contain no green substance whatever, so that he can no longer consider the presence of this green substance in the spongioles as necessary to cause the roots to bend towards the light. Seeking, then, for the cause of this phenomenon, and also that of the avoidance of light by the roots, M. Durand observed that this opposite direction under the influence of the same external cause, arose from the difference of that organisation in the roots which is necessary to give to vegetable tissues a tendency to curvature, which in one case is opposite to that it assumes in another, as M. Dutrochet has shown with respect to the stems that exhibit the same opposite tendency under the influence of light.

* *Comptes Rendus.*

THE ACTION OF SOLUBLE FERRUGINOUS SALTS APPLIED TO VEGETATION, AND PARTICULARLY IN THE TREATMENT OF CHLOROSIS AND DEBILITY IN PLANTS.*

BY M. GRIS.

THE author sums up, in the following terms, the result of the inquiries which had been the object of his new essay:—

1. Soluble ferruginous salts, whether absorbed by the spongioles of the roots of plants, or by the epidermis of the leaves, are stimulating, revivifying the *chromule*, as they revivify the *hematosine* of blood.

2. They revive and strengthen a weak plant, suffering under chlorosis, in the same manner as they do a languishing animal similarly affected.

3. The action of iron is, probably, identical, both in the animal and vegetable kingdoms.

* *Comptes Rendus*, Dec. 22, 1845.

4. The animation of the chromule, under the influence of ferruginous salts, absorbed by the pores of the leaves, proves, clearly, that the action of its compounds is special and direct—that is to say, independent of the soil; as is now generally admitted, in accordance with the opinion of Davy and other philosophers: nevertheless, on a chalky soil, I do not contest the accessory effects of sulphate of lime and carbonic acid, always, however, observing, that the ferruginous salts have, in general, as strongly, if not a more decidedly marked action, on soils that are purely alumino-silicious, and produce no effervescence with acids.

5. The saline stimulants, employed in agriculture, (without contesting their useful influence on the plant in a normal state), are without the power of producing the effects *specifically* caused by the soluble salts of iron, on a weak plant, suffering by chlorosis.

6. The ferruginous salts have appeared to me to stimulate advantageously the vegetation of a plant in its normal state, particularly when cultivated in pots. On account of their easy decomposition under the influence of the air, it is necessary, when they are applied to cultivation on a large scale, particularly in those cases of weakness in which I recommend them, to take peculiar precautions, the principal of which consists in employing them in very weak solutions, applied to the leaves themselves. In the quantity of 3 litres to every square metre, the expense of sulphate of iron would be about 5 centimes per acre, because, with one killogramme of this salt, we may prepare about 500 litres of the solution; of a proper strength, for watering the plants.

The price of this stimulant is also extremely low. Having concluded my labours, I am in hopes that useful consequences may result from the facts I have established, as well physiologically as practically.

ON COPPERING BY GALVANISM, WITHOUT THE EMPLOYMENT OF CYANIDE OF POTASSIUM.*

BY DR. L. ELSNER.

THE author has found, after numerous experiments, that a coppering liquor may be readily and cheaply obtained by the following process.

A given quantity of pulverized white bitartrate of potash is boiled in a porcelain basin, or in an enamelled cast-iron vessel, with about ten times its weight of rain-water, and to the liquid so much recently-prepared hydrated carbonate of copper, which has been washed with cold water added, that a portion of it remains undissolved as a basic greenish-blue powder, and the beautiful dark blue liquid has an alkaline reaction upon reddened litmus-paper. The liquid, filtered from the undissolved cream of tartar and hydrated oxide of copper, forms the coppering liquor; it is well to render the liquor strongly alkaline by the addition of a small quantity of carbonate of potash. The deep dark blue liquid thus prepared, contains in solution the double salt of tartrate of potash and copper, and may be preserved ready prepared without the least danger of alteration. The hydrated carbonate of copper required for the preparation of the above double salt is obtained by mixing a solution of sulphate of copper with a solution of carbonate of potash; a blue precipitate forms, which is collected on a filter or strainer and well washed with rain-water.

This liquor is employed in the usual way; the copper employed as a positive electrode dissolves readily in it, so that the solution is kept constantly at the same degree of concentration. A comparatively weak current, and perfect contact of the objects to be coated with the copper wire coming from the zinc pole, are requisite conditions for the operation to succeed well.

I have coppered tolerably large objects of cast-iron, zinc and tin with the above coppering liquor. The colour of the coated objects is quite the same as with a cyanide of potassium solution; the above liquor, therefore, replaces in every respect this highly poisonous and readily decomposable preparation, the expense moreover of which bears no proportion to that of the perfectly innocuous cream of tartar, which may moreover be had everywhere. The advantages of this copper liquor, in comparison to that prepared with cyanide of potassium, are self-evident, especially if we consider that large objects have hitherto been rarely coppered on account of the high price of the cyanide of potassium. Cast-iron or zinc statues, and large objects made of tin, may now be coated cheaply with copper, and in this way replace those obtained by electro-precipitation, which are far more expensive.

Before concluding this notice, I may observe, that it sometimes happens that the objects during the operation become variegated, a circumstance which generally occurs when the current is not properly in order. To remove this coloured coating, it is only necessary to take the object out of the liquor, and to wipe it with a cloth moistened with a little very dilute muriatic acid, which readily removes the coating.

* *Chem. Gaz.* and *Journ. für. Prakt. Chem.*

REDUCTION OF CHLORIDE OF SILVER.*

BY M. LEVOL.

LEVOL gives the following simple method of reducing chloride of silver. It is placed in a solution of caustic potash, in which some sugar is dissolved, and the whole boiled. The silver is quickly reduced by the sugar, carbonic acid gas being evolved, and is easily washed and obtained pure, and in the state of powder.

NOTE ON IRIDESCENT SILVER.†

BY PROF. JOHN BROCKELSBY.

IT is well known to those who are conversant with optical phœnomena, that the brilliant play of prismatic colours exhibited by mother-of-pearl is due to the structure of the surface, provided the shell is cut and polished in a particular manner. This interesting fact was announced to the scientific world in 1829 by the discoverer, Dr. Brewster, who successfully transferred by pressure the splendid tints of the pearl to black wax, fusible metal, balsam of tolu, lead, tin, and various other substances. The colours displayed by fusible metal possess at first extraordinary beauty, which in a short time is partially lost, owing to a change that occurs upon the surface of the metal.

A few months ago, while engaged upon some experiments in electrotyping, I was led to think that by this process the hues of the pearl might be readily transferred to those metals which, from their hardness are incapable of receiving impressions in mass, but yet, on account of their freedom from oxidation, retain for a long time a surface comparatively pure. I, therefore, took a Smee's battery, which I had just constructed, and after several experiments succeeded in obtaining small sheets of silver, radiant with the hues of the shell. When seen by a single light, as that of a lamp, the play of colours is surpassingly beautiful, scarcely inferior to that of the pearl; and where equal care was employed, the plate of silver, which was formed eight months ago, rivals in brilliancy that which came fresh from the battery a few hours since.

The process by which this result is obtained is as follows:—The first thing required is to prepare the shell. This is effected by grinding and polishing it upon the back, in such a manner as to cut through the numerous concentric strata that compose its substance. When this is done, by the aid of a microscope the surface will be seen covered with delicate grooves, some thousands in an inch, formed by the sections of the concentric laminæ, and this configuration gives rise to the glowing tints of the shell. The next step is to obtain an exact impression of this surface upon some good conductor of electricity. This we are enabled to do by means of fusible metal, if proper precautions are employed in taking the impression. I pursue exactly the same method as in taking the copy of a medal. After fusing the metal, I pour it upon oiled paper, and when the air-bubbles cease to rise through the metal the oxide is skimmed from its surface with a card; and as soon as it presents the appearance of a perfect mirror, the shell is forced down upon it by a sudden pressure. When the metal has cooled, I remove it from the shell, and having ascertained the accuracy of the impression, immediately plunge it, before any change of the surface can occur, into the silver solution, thereby completing the circuit between the poles of the battery. In a few moments the surface of the metal is frosted with silver, and the configuration of the shell exactly copied. A sheet of silver, of sufficient thickness to be easily removed with a penknife, will be deposited in the course of 5 or 6 hours under favourable circumstances. The battery I have employed consists of two plates of amalgamated zinc and one of platinized silver, 6 inches by 8. The working mixture is sulphuric acid and water, the strength varying with the temperature and the amount of work to be performed. I have found a wine-glassful of acid to 3 quarts of well-water, at the temperature acquired by standing a few hours in a room at 70° F., to answer very well when the surface to be plated did not exceed 1½ square inch. The silver solution is made by dissolving cyanide of potassium in water, and adding thereto the oxide of silver. The ratio of the ingredients I am unable to state, as I have not hitherto directed my attention to this point, but have prepared the solution by trial until I obtained the desired result.

By the process above described, we can at pleasure transfer the tints of the pearl to those pure metals which will best preserve their brilliancy; and while the knowledge of this fact is interesting as a matter of science, it may perhaps be well for the artist to consider if it cannot be applied to some ornamental purpose, and the beauty of the precious metals enhanced, by teaching them to glow with the richest hues of light.

* Berzelius' *Jahresbericht*, XXV.

†*Silliman's Journal, Jan.*, 1846.

TO CLEAN GLASS TUBES EMPLOYED IN THE COLLECTION OF METALIC RINGS OF ARSENIC, AND WHICH ARE STAINED WITH COPPER.*

BY M. A. CHEVALIER.

We know that we are recommended to encircle with copper, the glass tubes into which we cause the hydrogenated arsenic to pass, which has been reduced by means of heat.

Sometimes the metal melts on these glass tubes, and the result is a thick coating, which prevents our seeing the interior of the tube. We can easily obviate this inconvenience, by cleaning the upper parts of the tube, with very fine sand, moistened with hydrochloric acid; for this purpose, we moisten a rag with this acidulated sand, and rubbing the tube, the copper is soon removed, and the glass becomes again transparent.

ON A METHOD OF FORMING THE DUST OF GRAPHITE INTO A SOLID MASS.†

BY W. BROCKEDON, ESQ.

The *graphite*, or black-lead of commerce, of sufficiently good quality to be used for pencils, has become very scarce, only a small quantity being now raised in the Borrodale mines, and that of inferior quality, so that what has been sold lately is part of a large supply obtained forty years ago. This quantity having been picked over and over again, the former reputation of the Cumberland graphite is now no longer sustained, and its impurity is detected by artists in consequence of the grit which it often contains.

The author of this paper has contrived a method by which the fine dust of the best parts of the graphite may be recomposed into a mass as dense and compact, and of as close a texture as the best quality found in the mine. To effect this, the dust obtained from sawing graphite into thin plates and veneers, to be enclosed in the cedar, is carefully washed and ground, and by repeated operations is rendered pure and free from grit, being finally sifted through spaces less than $\frac{1}{10000}$th part of a square inch.

Thus prepared, the powder is placed under a powerful press on a strong die or bed of steel with air-tight fittings. The air is then pumped from the dust, and while thus free from air a plunger descends upon it, and it becomes solidified. The power employed to perform the operation is estimated at 1,000 tons, several blows having been given, each of this power.

Specimens of graphite, prepared by this process from the dust of the best Cumberland black-lead, were exhibited; one of them a block in a condition to be cut into thin plates for pencils; another a broken piece, showing the same smooth surface on both sides of the line of fracture, an appearance often observed in native graphite.

The author considers it a legitimate inference to be drawn from this process, that the fine sediment deposited from the detritus of rocks may be again converted into solid stone by mere pressure.

ON THE WAXY SUBSTANCES CONTAINED IN PLANTS.*

BY M. MULDER.

The substances that give a red and yellow colour to the leaves of plants, are accompanied by a peculiar waxy matter, on which M. Mulder has made several experiments.

This matter, extracted by means of ether, from the fruit of the service tree, *sorbus*, and freed as much as possible from the colouring matter, exactly resembles that obtained during the extraction of phlorigin. According to M. Mulder, the two products are even identical, and their composition can be represented as $C^{20} H^{32} O^{5}$.

It is insoluble in water, and less soluble in alcohol than ether, its melting point is 179° F., alkalies only partially convert it into soap, which seems to show that it is a compound of several substances.

M. Mulder also made several experiments on the waxy matter contained in the plant. It was extracted by means of ether, washed in cold alcohol, and re-dissolved in boiling alcohol, several times over, until it was colourless.

The leaves of the lilac and the vine yielded exactly the same product, and, a subject worthy of remark, this vegetable wax is identically the same as that of bees, as the following analyses prove:—

	Wax of the bee.	Wax of the leaves of lilac.
Carbon	79·83	80·46
Hydrogen	13·33	13·28
Oxygen	6·84	6·26
	100·00	100·00

* *Journ. de Chimie*, Feb. 1846.

† From the Proceedings of the Geological Society.

* *Journ. de Pharmacie.*, Feb. 1846.

NEW APPARATUS FOR EXTRACTING THE COLORING MATTER FROM DYE WOODS.*

BY M. IWAN SCHLUMBERGER.

At a meeting of your committee of chemistry I communicated the advantages which I had found in the apparatus of Mr. Meissonnier, for extracting the coloring matter of logwood. Some members appearing to doubt the real merit of this apparatus, from not having produced results analogous to mine, on trying it, I made some fresh experiments, which I explained to your committee of chemistry, accompanied by calculations which any other person might make.

It is of some of these experiments I am now about to speak.

In order to make decoctions of logwood, the usual method is, to put a quantity of shavings of that wood into a boiler in immediate contact with the fire, together with a quantity of water, sufficient to cover the wood completely, so that after boiling for some hours the wood may be quite covered. The operation is renewed twice with the same liquor, and after three successive boilings, the decoctions are mixed together and evaporated to the degree required.

This operation is attended with several disadvantages. Shavings only can be employed, for if the logwood be reduced to powder, it absorbs so much water that a great quantity of liquid is lost, and the shavings being rather thick, the water cannot readily penetrate, for which reason the time of boiling is very much prolonged.

Notwithstanding these three long boilings, if the same wood be boiled a fourth time, a liquid pretty well colored is obtained; which clearly shows that all the coloring matter has not been extracted.

Besides this, when decoctions of logwood are required in large quantities, very large vessels and extensive premises are necessary, as well as several furnaces, in order to produce a sufficient quantity: for the wood, when in shavings, is very bulky without being heavy, and large boilers are required for making a decoction from 50lbs. of shavings, with the necessary quantity of water. Several boilers must, therefore, be employed, otherwise the fire must be kept up day and night.

I will here describe, *en paisant*, for the benefit of those persons who have not many furnaces, but who have a steam-pipe at command, a method which I have employed for some time to make decoctions in great quantities, and which, I think, I can recommend in this instsnce.

A large high narrow vat, capable of containing about from 100 to 150lbs. of wood shavings, is mounted upon a stand or framing, and furnished with a cock below, in order to draw off the liquor. At a short distance above the cock, inside the vat, a false bottom or diaphragm, pierced with holes very close to each other, is fixed, in order to leave a space at the bottom to prevent the wood from clogging up the cock, and stopping the flow of the liquor. A steam-pipe, about one-third of an inch in diameter, is carried to the bottom of the vat, which is filled with shavings. It is covered with a cloth and a cover, which is weighted, in order to prevent the steam from issuing out in too great abundance. The shavings must not be heaped up more than in the common boilers. In this state, steam is allowed to flow in for an hour at least, until it escapes out in moderate quantities at the top. During this time the wood swells and becomes penetrated by the steam; then, when the vat is filled with water, it will be sufficient to heat to the boiling point, in order to obtain, the first time, a strong decoction. The vat is afterwards filled twice in succession, and made to boil as usual; and in the same space of time, with less labour a much larger quantity of decoction is obtained, and much more coloring matter extracted.

By the two methods just mentioned, considerable time is required for each operation, and the wood is not entirely exhausted of coloring matter; but with M. Meissonnier's apparatus much more advantageous results are attained.

This improved apparatus consists of a copper boiler of about a foot and half in width, and about two feet in depth. At a short distance from the bottom of the boiler is a false bottom, pierced with a multitude of holes, which sustains the wood in the water, and leaves an empty space for the boiling liquor. Into the boiler powdered wood is thrown, and it is covered first, with strong wire-work, and then with a copper-plate pierced with small holes, which cover is held firmly down upon the edges of the boiler by any suitable means. At the side of the boiler is a small lift and force pump, simply constructed, which draws the boiling water from any suitable vessel and forces it through a pipe into the empty space at the bottom of the boiler. The water after passing through the wood and the pierced cover of the boiler, is run off into any suitable receiver.

In our manufactory, at the side of the pump is a boiler, heated with a coal fire, capable of containing 450 quarts of water,

* *Newton's London Journal.*

which is to be boiled for each operation. After filling it, and lighting the fire, the other boiler is filled with powdered logwood, spread as evenly as possible, until it contains from 84 to 90 pounds of wood. The water having arrived at the boiling point is then forced into the space at the bottom of the vessel containing the dyewood, and driven up through the wood. In this manner, in two hours, the 450 quarts pass through and extract all the coloring matter from the dyewood.

The liquor which has passed through the wood is divided into three distinct portions, in this manner: a first portion of the decoction may be 3½° Beaumé; a second, 1½°; a third, ½°; and lastly, a fourth portion of liquid very slightly colored, which may be mixed with the water for the next operation. In this manner the most advantageous results are secured, as three decoctions of different degrees of strength are obtained at one working, without evaporation.

When a second operation is not commenced immediately, the waste heat of the furnace is employed to concentrate the liquor.

I will compare the advantages of this apparatus with that which we were obliged previously to use.

Thus, in a boiler heated by fire, 140 pounds of shavings and 80 quarts of water were put, and the liquor was boiled for four hours: this was renewed three times. For 40 pounds of logwood, it was, therefore, necessary to boil 240 quarts of water for twelve hours. I double these quantities the better to compare them with those produced by the new apparatus. Thus, by the old method, for 80 pounds of wood it was necessary to boil 480 quarts of water during twenty-four hours.

By the novel method, when from 84 to 90 pounds of wood are operated upon, two hours are necessary for heating the 450 quarts of water, and two hours for pumping it through the wood. Therefore, for 84 pounds of wood, it will be necessary to heat 450 quarts of water for four hours, effecting an economy of fuel for twenty hours' consumption.

Besides this, the coloring matter is better extracted, and a great economy of labour is effected, as one man can effect two operations per diem.

Several precautions are necessary, in fact indispensable, to ensure complete success; for instance, the wood must be very evenly spread, in order that the resistance offered to the water may be equal throughout; and, for this purpose, the wood must be put into the vessel in small quantities at a time. A very important point is, to have the wood ground or rasped of a uniform size, without fine dust, as the particles of this latter are apt to adhere together, and offer great resistance to the water at certain parts; thus preventing the coloring matter from being extracted therefrom. I have found that the wood spreads much better by previously wetting it.

For some other woods, such as Lima and Pernambuco woods, and other red dyewoods, 600 quarts of water, instead of 450, must be employed, as the coloring matter is not so easily extracted. Quercitron cannot be operated upon, as it is too fine a powder. Cochineal does not succeed, as it swells so much on coming in contact with boiling water, that, in an experiment I made, I thought it would have burst the boiler.

This apparatus is, however, very advantageous for the woods above-mentioned, if the directions given are carefully followed.

ON THE EMPLOYMENT OF AMMONIACO-MAGNESIAN PHOSPHATE AS MANURE.*

BY M. BOUSSINGAULT.

Ammoniaco-magnesian Phosphate contains the elements which appear to be the most necessary for the development of plants; it also possesses one of the properties belonging to gypsum, viz., a very slight degree of solubility.

On the 1st of May last, the author put a quantity of arable earth into stone vessels, capable of containing about nine square feet. These vessels were divided into two series, sixteen grammes of ammoniaco-magnesian phosphate were added to the earth contained in each of the first series, and in all the vessels a quantity of maize or Indian corn, which had already germinated was planted. All the vessels were placed out in the open air, and watered with an equal quantity of water when requisite.

During the first fifteen days after rising above the ground, all the plants presented the same appearance and vigour; it was only after the twenty-fifth day that a difference was perceived, and which was subsequently continued.

On the 25th July, the sprouts of the first series, which had been treated with the phosphate, were twice as high and three times as thick as those which had risen from the unprepared earth.

* *Newton's London Journal, or Repository of Art.*

On the 25th August, these proportions were different; the blades of the first being half as long again, and twice as thick, as the second.

All the blades were in ear at the same time; those which had been treated with the double salt bore three ears, two perfect and one imperfect; and the others only one perfect and one imperfect ear. The grain of the first weighed more than that of the second, in the proportion of two and a quarter to one.

ON THE PREPARATION OF A PURIFIED SOLUTION OF SHELL-LAC.*

BY DR. L. ELSNER.

From time immemorial cabinet-makers have employed a spirituous solution of bleached shell-lac for coating white woods with a polish. The bleaching of the shell-lac is generally effected on a large scale by chlorine or some of its compounds; and the bleached shell-lac then costs from 2s. 6d. to 3s. per lb., while excellent orange shell-lac may be had from 10d. to 1s. If the shell-lac which has been bleached by chlorine or its compounds or by sulphurous acid, contains but a small quantity of the body employed for that purpose, it frequently happens that on polishing furniture in which there are any inlaid metallic ornaments the latter become more or less tarnished. A method, therefore, for purifying the solution of the yellow shell-lac, without the employment of chlorine, sulphurous acid, or any similar substance, would have a two-fold advantage; in the first place, there would not be the least fear of injuring the metal; and in the second place, it would be far less expensive than the solution of the bleached shell-lac in spirits of wine.

To attain the object in view, I turned my attention to the application of charcoal, both animal and calcined vegetable. From a series of experiments, it became evident that the animal charcoal (granulated bone-charcoal) alone, was capable of yielding a practical and satisfactory result. For this purpose, equal quantities of light-colored shell-lac were dissolved in alcohol of 0·833 spec. grav. by digestion at a gentle heat, and the two different kinds of charcoal added respectively to the solutions; the digestion was now carried on for several days, and then the solution filtered through coarse blotting-paper. The solution which had been digested with animal charcoal had a light brownish color, was transparent and clear; maple, beech, and poplar were readily and beautifully polished by means of this solution, while that which had been digested with vegetable charcoal was of a darker color after filtration than before. The solution of the purified shell-lac may be readily prepared on a large scale in the following simple manner:—

Any quantity of yellow shell-lac, previously broken in small pieces, is conveyed into a glass flask, alcohol of 0·833 spec. grav. poured upon it, and the whole heated on the hob, or in summer in the sun, until the shell-lac is dissolved; upon this, so much coarsely-powdered animal charcoal (it must not be too fine, otherwise, on filtration, particles of the charcoal pass through the filter) is added to the solution so that the whole forms a thin paste. The flask is closed not quite air-tight, and left so for some time, exposed to the sun; and in 8 to 14 days a small sample is filtered to ascertain whether it has acquired a light yellowish-brown color, and whether it yields a clear, pure polish on light wood. If this be the case, it is filtered through coarse-blotting paper, for which purpose it is best to employ a tin funnel with double sides, similar to those employed in filtering spirituous solutions of soaps in the preparation of the transparent soaps, opodeldoc, &c. The space between the two funnels is filled with hot water, and the upper aperture covered with a tin lid. By this arrangement, the spirituous solution is kept warm, and does not stop up the pores of the paper; the tin cover prevents the evaporation of the spirit. The portion which first passes may be preserved separately, and be employed as a ground or first polish. Some more spirit is poured over the charcoal on the filter, and the solution used as a last coating.

The solution of shell-lac, purified by animal charcoal, has, it is true, a brownish-yellow color, but it is perfectly clear and transparent; when diluted with spirit, the color is so slight that it may be used in this state for polishing perfectly white wood, such as maple, poplar, and lime, without the wood acquiring the least tint of yellow. Several cabinet-makers of this town (Berlin), have employed the shell-lac polish thus prepared, and are perfectly satisfied with the results; I have also received a communication from Brunswick, stating that it has given general satisfaction.

* *Journ. für Prakt. Chem.*, xxxv. p. 374, and *Chemical Gazette*.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

AN ESSAY ON ALCOHOLIC TINCTURES.

BY M. JACQUES PERSONNE.

(*Continued from page 87.*)

27. GINGER.

								grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr.	0·54
„	60	„	4	„	„	56	„	1·62
„	75	„	5	„	„	id.	„	1·75
„	75	„	5	„	„	45	„	2·01
„	90	„	6	„	„	id.	„	1·80

This root owes its effects to a soft resin, on that account the Codex has directed the use of alcohol at 80° for this tincture. But if, on the one hand, we consider the enormous difference between the quantity of matter dissolved by alcohol of that strength, and alcohol at 56°; and, on the other hand, that this resinous matter may be perfectly removed by means of the extractive matter, alcohol at 56°, and 5 pts. of this solvent will be employed according to my plan, and this is the proportion also that takes up the greatest quantity of the soluble matter.

28. CINNAMON.

								grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr.	2·61
„	75	„	5	„	„	id.	„	2·69
„	90	„	6	„	„	id.	„	2·73
„	60	„	4	„	„	56	„	2·73
„	75	„	5	„	„	id.	„	2·80
„	60	„	4	„	„	45	„	2·70
„	75	„	5	„	„	id.	„	2·72

The two last tinctures are so mucilaginous, they can scarcely be filtered.

As we see by this table, there is no great difference between the quantities of matter dissolved by alcohol of these different degrees of strength, but, considering that the weaker the alcohol is, the more mucilaginous the tinctures are, and that the active principle of this bark resides in its essential oil, I give the preference, as in the Codex, to alcohol at 80°; and rejecting the trifling excess of matter dissolved by six parts of this solvent, I should adopt the proportion of five parts.

29. SAFFRON.

								grs.
1 pt.	15 gr.	by	60 gr.	or	4 pts.	alco. at 80°	total extr.	8·10
„	60	„	4	„	„	70	„	8·69
„	60	„	4	„	„	56	„	9·06
„	75	„	5	„	„	id.	„	10·86
„	90	„	6	„	„	id.	„	10·80
„	60	„	4	„	„	45	„	8·89
„	75	„	5	„	„	80	„	8·71

The last two tinctures are very mucilaginous. We add, according to these experiments, that weak alcohol at 55°, extracts more from the saffron than alcohol at 80°; but, as it has been observed that a tincture prepared with weak alcohol, deposits, after a certain time, a considerable quantity of coloring matter, and—that it can, therefore, be no longer identical in composition, while that prepared with alcohol at 80°, is much more stable, I retain, according to the Codex, alcohol at 80°, for the preparation of this tincture, only I should employ five parts of this solvent, which is the proportion that produces the greatest quantity of extract from the same weight of the substance.

grs.

extr. 6·00
6·30
6·60
6·50
6·45
6·00
5·95

and transparent, in the
resinoid mass floated.
that these two alcohols had
r quantity of the active
much greater quantity of
substances. I, therefore,
e employed in the Codex.
s of this solvent would be
to exhaust this substance,
ss to the general rule,
tion of 3 parts of alcohol,
similar cases are too few

grs.

al extr. 2·22
2·67
3·03
3·12
3·25
3·18

tion adopted by the Codex
great power of the medi-
to ascertain what strength
best. We see, according
ved in this table, that pe-
given to alcohol at 60°,
employment of this vehi-
e Codex.

grs.

extr. 4·12
3·57
3·06
3·18
4·38
4·50
4·23
4·18
4·26
2·32
3·25

the use of alcohol of the same
number of substances, on
The experimented, amount to 32,
experiments are sufficiently
able me to draw the fol-
from their results:—

CONCLUSIONS.

1. The degrees of strength of the alcohol prescribed by the Codex, are not always the most favorable for the solution of the largest quantity of the principles contained in the substances employed in the preparation of tinctures.

2. These degrees of strength can scarcely be admitted in a general manner, and by analogy, excepting in the case of a certain number of substances. Experiment alone can determine which is the best in each case.

3. The proportion of four parts of alcohol, for one of the substance employed in the Codex, is scarcely, in any case, sufficient to dissolve, entirely, the soluble parts of these bodies. The cases in which this proportion is sufficient are so rare as to prevent any generalisation.

4. The quantity of alcohol necessary entirely to exhaust a substance, is, in general, five parts of alcohol for one of the substance. In certain cases, however, but extremely rarely, this proportion is not quite strong enough, but the excess of matter dissolved is so trifling, that it may be left out of the question in laying down a general rule.

5. The quantity of alcohol is always sufficient to exhaust a substance, when that solvent is in sufficient quantity to cover it, and when the substance is herbaceous, as in the case of leaves.

6. The degrees of strength of the alcohol, which I have found most adapted for the preparation of different tinctures, are 80°, 56°, and 45°.

We shall find these different degrees of strength arranged in the following table, along with the substances for which they are adapted. I have also added, in the case of each of these tinctures, the quantity of substance equivalent to 1 gramme of the tincture.

Before I conclude I must mention a singular fact, which, as we may perceive, presented itself in almost every experiment: in almost every instance when the proportion of alcohol was too great, I always obtained less extract than when it was just enough; that is to say, the more I increased the quantity of the alcohol, the more the quantity of extract was decreased.

This fact, analogous to that which I have often observed, when water is added to a concentrated solution of opium, when we see substances precipitated that were previously held in solution; this fact, I say, sufficiently proves, that there is a great inconvenience in too much increasing the proportion of alcohol in the preparation of tinctures; for, besides that, the density of the tincture would be diminished by this addition of alcohol, it would be still more so, by the precipitation of a certain quantity of matter, as occurs in the case of the solution of opium.

A TABLE OF THE DIFFERENT STRENGTH OF ALCOHOL TO BE EMPLOYED IN THE PREPARATION OF EACH SUBSTANCE.

We prepare, with 1 part of the substance and 5 parts of alcohol at 80°, the tinctures of—

Yellow bark	1 gr.	of tincture, equal, to	0·20 in powder.
Jalap	1 gr.	,,	0·19 ,,
Cinnamon	1 gr.	,,	0·20 ,,
Pellitory of Spain	1 gr.	,,	0·20 ,,
Saffron	1 gr.	,,	0·17 ,,
Castoreum	1 gr.	,,	0·18 ,,
Myrrh	1 gr.	,,	0·19 ,,

1 part of the substance and 5 parts of alcohol at 56° for the following tinctures:—

Rhubarb	1 gr.	of tincture, equal to	0·18 in powder.
Wormwood	1 gr.	,,	0·19 ,,
Gray bark	1 gr.	,,	0·20 ,,
Ipecacuanha	1 gr.	,,	0·19 ,,
Nux vomica	1 gr.	,,	0·20 ,,
Gentian	1 gr.	,,	0·18 ,,
Red bark.....	1 gr.	,,	0·20 ,,
Foxglove	1 gr.	,,	0·18 ,,
Senna	1 gr.	,,	0·19 ,,
Squills.....	1 gr.	,,	0·17 ,,
Black hellebore ..	1 gr.	,,	0·18 ,,
Root of azarum ..	1 gr.	,,	0·19 ,,
Contrayerva	1 gr.	,,	0·20 ,,
Milkwort	1 gr.	,,	0·18 ,,
Ginger.....	1 gr.	,,	0·20 ,,

According to the Codex, 8 parts of alcohol at 56° are required for tincture of cantharides.

We prepare, with 1 part of the substance, and 5 parts of alcohol, at 45°, the following tinctures:—

Valerian root	1 gr.	of tincture,	equal to 0·19	in powder.
White hellebore	1 gr.	,,	0·18	,,
Bulbs of meadow saffron ..	1 gr.	,,	0·19	,,
Leaves of azarum	1 gr.	,,	0·19	,,
Wolf'sbane	1 gr.	,,	0·19	,,
Hemlock	1 gr.	,,	0·18	,,
Belladonna	1 gr.	,,	0·19	,,
Henbane	1 gr.	,,	0·18	,,
Strammonium	1 gr.	,,	0·18	,,

As to the mode of preparing these tinctures, I think experience has sufficiently proved that of all the plans proposed, cold maceration is the best.

THE QUANTITIES OF MEDICINAL HERBS SUPPLIED TO THE LONDON MARKET.

	FROM MITCHAM.		FROM OTHER PLACES.	TOTAL.
	Average of 3 years, 1840-41-42.	Average of 3 years. 1843-44-45.	Average of 3 years, 1843-44-45.	Average of 3 years, 1843-44-45.
Camomile flowers	12 tons	4 tons	16 cwt.	4 tons 16 cwt.
Red-rose petals	5000 lbs.	2200 lbs.	——	2200 lbs.
Poppy capsules, whole.....	350,000	200,000	750,000	950,000
,, ,, broken....	4 tons	2 tons	2 tons	4 tons
Liquorice root.....	30 tons	12 tons	3 tons	15 tons
Angelica root	2 tons	5 cwt.	5 cwt.	10 cwt.
Henbane plant.....	6 tons	5 tons	15 tons	20 tons.
Belladonna plant.....	4 tons	2½ tons	3½ tons	6 tons.
Stramonium.....	16 cwt.	4 cwt.	18 cwt.	22 cwt.
Aconite	12 cwt.	7 cwt.	14 cwt.	21 cwt.
Savine	25 cwt.	25 cwt.	——	25 cwt.
Wormwood	10 cwt.	10 cwt.	1 ton	1½ ton.
Rhubarb root	——	——	20 tons from Banbury.	20 tons.

AN EASY METHOD OF ASCERTAINING THE GENUINENESS OF GUAIACUM WOOD.*

BY J. H. SCHWACKE.

When a few drops of a solution of perchloride of mercury are poured over some shavings of guaiacum wood in a test-tube and slightly warmed over a spirit-lamp, a bluish-green colour is immediately produced with all genuine samples. This test is easier than that by means of nitrous vapours, and is probably owing to the same cause as the blue colouring of guaiacum wood described by Schacht.

* *Archiv der Pharm.*, xliv. p. 178.

NOTICE ON THE APPLICATION OF THE SPHEROIDAL STATE TO THE ANALYSIS OF THE SPOTS PRODUCED BY MARSH'S APPARATUS.*

BY M. BOUTIGNY.

A spot produced by Marsh's apparatus being given, to ascertain whether it is arsenical or not?

The solution of this problem by the old analytical process is almost impossible: but by having recourse to the following artifice we may easily show whether the spot is occasioned by arsenic:—

* *Comptes Rendus.*

We first circumscribe it with a glass rod, previously moistened with water containing $\frac{1}{100}$th of pure nitric acid; we then allow a drop of the same acid to fall upon it, so that it shall not be in contact with more than about one milligramme of the real acid. We warm it gently, and, if the spot is arsenical, it disappears almost immediately: it is then transformed into arsenious and arsenic acids. We allow the capsule to become cold, and then direct a current of hydrosulphuric acid, arising from the decomposition of water over the sulphuret of iron, by means of sulphuric acid, on the place where the spot was found, and a yellow spot will soon appear where the original shining mark was seen, if the spot be arsenical.

The disengagement of hydrosulphuric acid from the sulphuret of iron is a condition indispensable to success. That which arises from the action of sulphuret of antimony on hydrochloric acid, as it always deposits sulphur, would destroy the precision of the ulterior reactions.

The yellow spot obtained in the manner I have described above is dissolved in 1 gramme of very pure liquid ammonia; a platinum capsule is made red-hot, and we pour into it, drop by drop, the colourless ammoniacal solution, which passes into the spheroïdal state. It forms a very flat spheroïd, the horizontal diameter of which constantly diminishes, its axis, or vertical diameter, remaining unchanged. When the spheroïd is transformed into a sphere, and it is no larger than a small pea, you touch it with a tube moistened in hydrochloric acid, and the spheroïd, from being colourless as it was, becomes yellow; we allow a drop of ammonia to fall upon it, and it loses its colour to become again yellow when touched with hydrochloric acid.

These changes from a colourless to a coloured state may be produced almost indefinitely. This is a characteristic that belongs exclusively to sulphuret of arsenic, which has an analogy in regard to colour with sulphuret of cadmium; but the latter being insoluble in ammonia, the two sulphurets cannot be compounded, and error is impossible. When the preceding re-actions have been carefully obtained, a small crystal of carbonate of soda, weighing 0·05, is placed in the spheroïd; the capsule is withdrawn from the action of heat, and placed on a flat metallic surface, the temperature rapidly falls, and the spheroïd spreads itself out almost immediately on the most inclined part of the surface. The small saline mass is then carefully collected, and placed at the bottom of a closed tube, the part containing the salt is brought to a red heat, holding the tube in a horizontal position, and almost immediately there appears on the upper side of the tube that which was first seen on the capsule.

The tube being cold, it is divided so as to separate as nearly as possible the part on which the spot is placed; we then pulverise it in an agate mortar, and project it on a large piece of strongly ignited charcoal. You bend your head over the charcoal at the distance of 20 or 30 centimetres, and the garlick-like smell of arsenic is perceived, then there can be no further doubt the spot is arsenical.

This last experiment must be made in a closed room, to avoid the currents of air that might drive off the arsenical vapours.

I had already, at a former time, applied the spheroïdal state to the analysis of a microscopic spot of blood. M. Chambert did the same by employing water in the spheroïdal state as an agent of combustion, to consume the organic matters contained in salts, obtained by the evaporation of urine, and I have no doubt that before long I shall be able to cite other important results obtained by the study of matter in a spheroïdal state.

OBSERVATIONS ON A NEW SUBSTANCE BROUGHT FROM AMERICA.*

BY M. GUIBOURT.

In the month of August last, M. Leroy, a pharmacist at Brussels, sent me a volatile oil, very remarkable, on account of its flowing abundantly from a vegetable, without its being necessary to have recourse to distillation to obtain it. I much regret that I have neglected this communication up to the present time. At Bogota, from whence it is brought, this oil is called *aceite of copaiba*. The tree that produces it is at present unknown, but it grows abundantly in the moist virgin forests in the neighbourhood of Bogota; it contains so large a quantity of the essence, that it is sufficient to wound a branch, and suspend a vessel from it, to collect a litre in a very few minutes.

This essence is liquid, of a very pale yellow colour, not greasy to the touch, its taste is sweet at first, then hot, pungent, and bitter. Cold, a few degrees above the freezing point, does not render it solid. Its smell, according to M. Leroy, much resembles that of orange blossoms, but to me it appeared more like that of the rose, or rather the essence of *licari*, rosewood. M. Guibourt, to

* *Journal de Pharmacie*, Feb. 1846.

whom I showed it, told me that this essence came from forests situated about seven or eight leagues from Bogota, but he was not acquainted with the tree that produced it, and that it was employed at Bogota in the adulteration of copaiba. It is, in fact, certain that the copaiba that reaches us from Maracaibo and other parts of Columbia, much resembles it in smell; this, up to the present time, has been attributed to it, solely, on the ground that it was produced by a particular species of *copaifera*.

A SUBSTITUTE FOR THE COMMON BLACK DRAUGHT.

℞—Potassio-tartrate of soda.. 1 drachm;
Compound senna liquor, 2 or 3 drachms;
Water, ... 1½ oz.;
Aromatic spirit of ammonia, 10 minims.

A teaspoonful of this liquor is an admirable purgative for children; and no child, however averse to medicine, will hesitate to take it, from anything connected with its taste.

STYPTIC LOTION OF BROCHIERI.*

℞—The wood of the fir, cut small and bruised ..... 1 part.
Water ..... 2 parts.

Let it macerate for 12 hours, and distil over a portion of the product. It is then left at rest for 24 hours, and we remove the essential oil. This water must be shaken before used.

HEMOSTATIC WATER OF NELJABIN.†

	Grs.
℞—Siberian castorium	30
Ambergris	30
Ergot of rye	125
Balsam of Mecca	12
Canada balsam	60
Cinnamon	420
Rosemary flowers	750
Sprigs of peppermint	360
Cajeput oil	15
Rectified alcohol	500
Water	q. s.

Bruise or cut all these substances; let them macerate for twelve hours in the alcohol and water, and distil so as to pass over 2·750 parts of the product.

* *Arch. de Pharm.*
† *Ibid.*

COD-LIVER OIL IN CHRONIC RHEUMATISM.*

Dr. Bradshaw describes several cases of chronic rheumatism, some of which were severe, in which a cure was effected by the exhibition of train oil internally, in doses gradually raised from a teaspoonful to a wineglassful three times a day. He believes that the remedy acts beneficially by its stimulating effects. He considers the fine-drawn blubber oil obtained from the whale, when obtained pure, to be quite as efficacious as that procured from the cod's liver. He is in the habit of administering the remedy in various vehicles, as circumstances require, or the condition of the patient demands, such as cinnamon and peppermint waters, thin gruel, milk, and the alcoholic potions, but gives the preference to a thin infusion of linseed, flavoured with lemon peel, and sweetened to please the palate. The mode of giving the oil with this, is in form as follows:—A small quantity of infusion is poured into a glass, to which is added the oil, and again another small quantity of infusion upon it. In this manner the dose may be taken, and will slip down without offending the palate, and generally is well retained even by irritable stomachs. Another mode has been successful where many have failed, and will be found equally valuable; it is the yolk of an egg beat up with boiling water and sugar, with which may be mixed a dessertspoonful of brandy, and on this the dose may be given without producing that nausea so frequently experienced when conveyed by other vehicles.

THE QUANTITY OF LEECHES IMPORTED INTO FRANCE IN 1844.†

BY M. VIREY.

German association, including Hungary	4,170,800
Belgium	278,000
Hanseatic towns	251,000
England	679,500
Spain	610,950
Sardinian States	5,134,123
The two Sicilies	4,000
Switzerland	404,500
Turkey, in Europe and Asia ..	2,133,700
Barbary States	352,800
Algeria and Kabylia.....	1,219,100
United States of America	3,000
	15,232,673

* *Provincial Medical Journal.*
† *Jour. de Pharmacie*, Feb. 1846.

HINTS FOR PHARMACEUTICAL MEMBERS.*

Before many weeks have elapsed, it will become the duty of the members of the Pharmaceutical Society to nominate those gentlemen whom they may be desirous of seeing elected on the Council at the next annual meeting, to be held in May. I have been informed, on good authority, that private meetings of the members have taken place at the houses of two or three of the Council (in humble imitation of the political leaders of the House of Commons, with this difference only, they all were for the same purpose) to adopt plans, and to give promises of support to the coterie, which invoked them in the ensuing campaign. Now, I fearlessly assert that these hole-and-corner proceedings are an injustice and an insult to those who were not invited to participate in the dellberations; it is a gross and treacherous outrage perpetrated by the influential members of the society on their more humble and not less worthy brethren, who, confiding in their integrity, candour, and identity of purpose, find all their suggestions set at nought, and themselves treated with superciliousness and contempt by a disciplined and packed assembly, composed of these gentlemen and their friends—men who believe the high road to honor and office is more easily to be obtained by supporting the interested prejudices and vicious schemes of those who (to use a vulgar phrase) have got the staff in their own hands and mean to keep it.

It is, doubtless, palpable to all, that the management of the society is confined to the aristocrats of the trade—they having some time since thrown overboard the few unassuming members who were amongst the originators of the society, and who represented the less wealthy class, which for numbers, respectability, and intelligence, constitute the chief and paying body of the society. I, therefore, call upon this great majority not to let another opportunity pass by without exercising their rights and privileges, by having their interests understood, and their position recognised, in the Council. Let them not, from diffidence and want of a proper degree of self-respect, at this important period, when the existing tone of the society may be irremediably established by legal enactment, tamely submit to the election of a clique by a packed minority of members, and vainly fancy they have in it the proper exponents and guardians of their welfare, which such critical circumstances require.

I earnestly entreat the unobtrusive members I am now addressing not to be deceived by the duplicity of this *soi-disant*, hard-working, self-sacrificing Council, who, at the annual meetings, with solemn words and appropriate gestures, declare their irksomeness of office, and their wish to serve only for the general good. The value of these asseverations may be estimated, when I state, from my own knowledge, that the businesses of several of these benevolent individuals have increased very considerably from their official connection with the society. The fact will be easily accounted for when it is remembered how frequently the members of the Council come in contact with the principal physicians and surgeons; how many little courtesies they have the opportunity of conferring by invitations to the meeting, &c., and giving favorable notices of works published by the profession in the *Pharmaceutical Journal;* and also how many occasions they enjoy for pressing on the attention of medical men the excellency of their infusions and decoctions, and the admirable manner in which they conduct their businesses generally. Such advantages as these can never be participated in by the private members of the society, to their great detriment.

If any member wishes for a further corroboration of these statements, let him get elected on the Council for two or three years, and he will then find, with a moderate share of cunning and address, by his balance-sheet at the year's end, what is meant in the Pharmaceutico-Council language, by great sacrifices for the general good. In order to give him fair play, when elected, I will throw him out a hint as to his proceedings. Let him purchase or make, either some very bad or very good preparation, it matters not which, so long as it has a different appearance from that in general use, or that ordered by the pharmacopœa. Let him put it in an appropriate vessel, with a handsome label, and name and address very distinct, and get up a good tale, with a few hard words in it, ready cut and dried, of the method of preparing the aforesaid. Let him attend the first evening meeting, after having been elected one of the Council, and place this preparation on the table, and after it has been well inspected, let him present a sample of it to any physician or surgeon, who is willing to make

* We have inserted the above letter from our correspondent, because, supposing him to have been correctly informed, as to the proceedings of some of the leading members of the society, his statement shows that the less influential portion of the body, ought carefully to watch their proceedings—Ed.

a trial of it, and there are always plenty to do so, especially when they have discovered his official dignity. He may then rest assured, that in a few days he will be gratified, supposing, for example, the substance to have been Extract Taraxaci, by receiving the following result, namely, a prescription, as a recompense for his skill and labours, through the medium of a new customer :—

℞—Ext. taraxaci . . . ʒ j.
Aquæ distil. . . . ʒ iij.
Ft. guttæ

GAMMON & Co., A.S.S., M.D.

For Mr. Victim.

This one experiment will convince the novice of the necessity of a degree of modest assurance, and the utter worthlessness of pursuing science, for honour or profit. I could multiply these delicate intimations, and may do so on an early occasion, but I trust what I have written, will be a sufficient inducement to members to stand forward and show that there are other interests to be represented in the Council, besides those of Oxford or Bond Streets, and that each member has a right, and will maintain it in his turn, to the beneficial occupation of office in the society.

W. B.

REPORT ON A NOTE BY M. DAVALLON ENTITLED "A FEW WORDS ON THE PREPARATION OF WATERY EXTRACTS."*

BY MESSRS. VERON AND GOBLEY.

THE object we aim at in the preparations of extracts is the obtaining a product which shall possess, as much as possible, the properties of the organic substance from which it has been prepared.

The operation is divided into two parts: in the first, a solution is made, containing the soluble principles of the plants; in the second, we evaporate the liquid. In general, to obtain extracts, we evaporate it in the sand-bath, by continually agitating the impregnated liquor, and by the digestion, infusion, decoction, or lixiviation of the soluble principles of the organic matter, until it is reduced to about ¼ of its original volume; we allow it to settle, decant the liquid from the deposit, and evaporate it in a sand-bath to the consistence of an extract.

M. Davallon says that extracts, prepared in this manner, contain a notable quantity of inert matters, generally of a gelatinous or feculant nature; the proportion, he says, is in general larger, as the substances have been acted on at a lower temperature, this is due to the non-coagulation of the vegetable albumen, which, if we operate at a higher temperature, retains the fecula and the chlorophyl of the substances submitted to the solvent power of the water, as it were in a net.

Starting on this principle, his advice is to evaporate the liquids, which ought to be perfectly limpid, until their density is from 20° to 25° by a saccharometer; to allow them to cool, and filter them through unsized paper, previously moistened, for he has observed, that by taking this precaution the liquid is more rapidly filtered.

We think, with M. Davallon, that we may submit the liquids to this species of filtration, although it is often extremely tedious, because we have ascertained that it is the only means of separating the whole of the insoluble matters. The liquid, when evaporated over an open fire, has not, in most cases, appeared to filtrate as rapidly as that obtained by the sand-bath. The deposit formed, when left at rest, is often so light and flocculent that it is impossible to separate it perfectly from the liquid, even by passing it through a sieve; this deposit is lighter, and in more minute particles, when it arises from liquids evaporated by the sand-bath; it is heavier and in larger particles, when produced over the open fire.

Let us now proceed to the second part of the preparation of extracts—the evaporation of the liquids.

If it were always possible to operate in a vacuum, this mode of evaporation would be incontestibly the best, but the impossibility in which pharmacists find themselves placed, of preparing a proper apparatus, prevents these medicines being employed medicinally, for, in our opinion, the first position to be established in the case of a medicine is, that every pharmacist may be able to prepare it.

In our laboratories, evaporation is effected by means of heat; formerly this was done over an open fire, but as it was ascertained that the extractive matter was injured, particularly while boiling, it was recommended to be done by means of steam.

Of all the kinds of apparatus that have been proposed, the simplest consists of two bowls placed one above the other; the lower one contains the water, and furnishes the steam. The evaporation proceeds very rapidly, when we employ a very wide and shallow bowl, and we take care to move it about quickly. In taking this last precaution, scarcely any steam passes through the

* *Jour. de Pharmacie*, Jan. 1846.

TO CLEAN GLASS TUBES EMPLOYED IN THE COLLECTION OF METALIC RINGS OF ARSENIC, AND WHICH ARE STAINED WITH COPPER.*

BY M. A. CHEVALIER.

We know that we are recommended to encircle with copper, the glass tubes into which we cause the hydrogenated arsenic to pass, which has been reduced by means of heat.

Sometimes the metal melts on these glass tubes, and the result is a thick coating, which prevents our seeing the interior of the tube. We can easily obviate this inconvenience, by cleaning the upper parts of the tube, with very fine sand, moistened with hydrochloric acid; for this purpose, we moisten a rag with this acidulated sand, and rubbing the tube, the copper is soon removed, and the glass becomes again transparent.

ON A METHOD OF FORMING THE DUST OF GRAPHITE INTO A SOLID MASS.†

BY W. BROCKEDON, ESQ.

The *graphite*, or black-lead of commerce, of sufficiently good quality to be used for pencils, has become very scarce, only a small quantity being now raised in the Borrodale mines, and that of inferior quality, so that what has been sold lately is part of a large supply obtained forty years ago. This quantity having been picked over and over again, the former reputation of the Cumberland graphite is now no longer sustained, and its impurity is detected by artists in consequence of the grit which it often contains.

The author of this paper has contrived a method by which the fine dust of the best parts of the graphite may be recomposed into a mass as dense and compact, and of as close a texture as the best quality found in the mine. To effect this, the dust obtained from sawing graphite into thin plates and veneers, to be enclosed in the cedar, is carefully washed and ground, and by repeated operations is rendered pure and free from grit, being finally sifted through spaces less than $\frac{1}{5000}$th part of a square inch.

Thus prepared, the powder is placed under a powerful press on a strong die or bed of steel with air-tight fittings. The air is then pumped from the dust, and while thus free from air a plunger descends upon it, and it becomes solidified. The power employed to perform the operation is estimated at 1,000 tons, several blows having been given, each of this power.

Specimens of graphite, prepared by this process from the dust of the best Cumberland black-lead, were exhibited; one of them a block in a condition to be cut into thin plates for pencils; another a broken piece, showing the same smooth surface on both sides of the line of fracture, an appearance often observed in native graphite.

The author considers it a legitimate inference to be drawn from this process, that the fine sediment deposited from the detritus of rocks may be again converted into solid stone by mere pressure.

ON THE WAXY SUBSTANCES CONTAINED IN PLANTS.*

BY M. MULDER.

The substances that give a red and yellow colour to the leaves of plants, are accompanied by a peculiar waxy matter, on which M. Mulder has made several experiments.

This matter, extracted by means of ether, from the fruit of the service tree, *sorbus*, and freed as much as possible from the colouring matter, exactly resembles that obtained during the extraction of phlorigin. According to M. Mulder, the two products are even identical, and their composition can be represented as $C^{20}\ H^{32}\ O^{5}$.

It is insoluble in water, and less soluble in alcohol than ether, its melting point is 179° F., alkalies only partially convert it into soap, which seems to show that it is a compound of several substances.

M. Mulder also made several experiments on the waxy matter contained in the plant. It was extracted by means of ether, washed in cold alcohol, and re-dissolved in boiling alcohol, several times over, until it was colourless.

The leaves of the lilac and the vine yielded exactly the same product, and, a subject worthy of remark, this vegetable wax is identically the same as that of bees, as the following analyses prove:—

	Wax of the bee.	Wax of the leaves of lilac.
Carbon	79·83	80·46
Hydrogen	13·33	13·28
Oxygen	6·84	6·26
	100·00	100·00

* *Journ. de Chimie*, Feb. 1846.

† From the Proceedings of the Geological Society.

* *Journ. de Pharmacie.*, Feb. 1846.

NEW APPARATUS FOR EXTRACTING THE COLORING MATTER FROM DYE WOODS.*

BY M. IWAN SCHLUMBERGER.

At a meeting of your committee of chemistry I communicated the advantages which I had found in the apparatus of Mr. Meissonnier, for extracting the coloring matter of logwood. Some members appearing to doubt the real merit of this apparatus, from not having produced results analogous to mine, on trying it, I made some fresh experiments, which I explained to your committee of chemistry, accompanied by calculations which any other person might make.

It is of some of these experiments I am now about to speak.

In order to make decoctions of logwood, the usual method is, to put a quantity of shavings of that wood into a boiler in immediate contact with the fire, together with a quantity of water, sufficient to cover the wood completely, so that after boiling for some hours the wood may be quite covered. The operation is renewed twice with the same liquor, and after three successive boilings, the decoctions are mixed together and evaporated to the degree required.

This operation is attended with several disadvantages. Shavings only can be employed, for if the logwood be reduced to powder, it absorbs so much water that a great quantity of liquid is lost, and the shavings being rather thick, the water cannot readily penetrate, for which reason the time of boiling is very much prolonged.

Notwithstanding these three long boilings, if the same wood be boiled a fourth time, a liquid pretty well colored is obtained; which clearly shows that all the coloring matter has not been extracted.

Besides this, when decoctions of logwood are required in large quantities, very large vessels and extensive premises are necessary, as well as several furnaces, in order to produce a sufficient quantity: for the wood, when in shavings, is very bulky without being heavy, and large boilers are required for making a decoction from 50lbs. of shavings, with the necessary quantity of water. Several boilers must, therefore, be employed, otherwise the fire must be kept up day and night.

I will here describe, *en paisant*, for the benefit of those persons who have not many furnaces, but who have a steam-pipe at command, a method which I have employed for some time to make decoctions in great quantities, and which, I think, I can recommend in this instsnce.

A large high narrow vat, capable of containing about from 100 to 150lbs. of wood shavings, is mounted upon a stand or framing, and furnished with a cock below, in order to draw off the liquor. At a short distance above the cock, inside the vat, a false bottom or diaphragm, pierced with holes very close to each other, is fixed, in order to leave a space at the bottom to prevent the wood from clogging up the cock, and stopping the flow of the liquor. A steam-pipe, about one-third of an inch in diameter, is carried to the bottom of the vat, which is filled with shavings. It is covered with a cloth and a cover, which is weighted, in order to prevent the steam from issuing out in too great abundance. The shavings must not be heaped up more than in the common boilers. In this state, steam is allowed to flow in for an hour at least, until it escapes out in moderate quantities at the top. During this time the wood swells and becomes penetrated by the steam; then, when the vat is filled with water, it will be sufficient to heat to the boiling point, in order to obtain, the first time, a strong decoction. The vat is afterwards filled twice in succession, and made to boil as usual; and in the same space of time, with less labour a much larger quantity of decoction is obtained, and much more coloring matter extracted.

By the two methods just mentioned, considerable time is required for each operation, and the wood is not entirely exhausted of coloring matter; but with M. Meissonnier's apparatus much more advantageous results are attained.

This improved apparatus consists of a copper boiler of about a foot and half in width, and about two feet in depth. At a short distance from the bottom of the boiler is a false bottom, pierced with a multitude of holes, which sustains the wood in the water, and leaves an empty space for the boiling liquor. Into the boiler powdered wood is thrown, and it is covered first, with strong wire-work, and then with a copper-plate pierced with small holes, which cover is held firmly down upon the edges of the boiler by any suitable means. At the side of the boiler is a small lift and force pump, simply constructed, which draws the boiling water from any suitable vessel and forces it through a pipe into the empty space at the bottom of the boiler. The water after passing through the wood and the pierced cover of the boiler, is run off into any suitable receiver.

In our manufactory, at the side of the pump is a boiler, heated with a coal fire, capable of containing 450 quarts of water,

* *Newton's London Journal.*

which is to be boiled for each operation. After filling it, and lighting the fire, the other boiler is filled with powdered logwood, spread as evenly as possible, until it contains from 84 to 90 pounds of wood. The water having arrived at the boiling point is then forced into the space at the bottom of the vessel containing the dyewood, and driven up through the wood. In this manner, in two hours, the 450 quarts pass through and extract all the coloring matter from the dyewood.

The liquor which has passed through the wood is divided into three distinct portions, in this manner: a first portion of the decoction may be 3½° Beaumé; a second, 1½°; a third, ½°; and lastly, a fourth portion of liquid very slightly colored, which may be mixed with the water for the next operation. In this manner the most advantageous results are secured, as three decoctions of different degrees of strength are obtained at one working, without evaporation.

When a second operation is not commenced immediately, the waste heat of the furnace is employed to concentrate the liquor.

I will compare the advantages of this apparatus with that which we were obliged previously to use.

Thus, in a boiler heated by fire, 140 pounds of shavings and 80 quarts of water were put, and the liquor was boiled for four hours: this was renewed three times. For 40 pounds of logwood, it was, therefore, necessary to boil 240 quarts of water for twelve hours. I double these quantities the better to compare them with those produced by the new apparatus. Thus, by the old method, for 80 pounds of wood it was necessary to boil 480 quarts of water during twenty-four hours.

By the novel method, when from 84 to 90 pounds of wood are operated upon, two hours are necessary for heating the 450 quarts of water, and two hours for pumping it through the wood. Therefore, for 84 pounds of wood, it will be necessary to heat 450 quarts of water for four hours, effecting an economy of fuel for twenty hours' consumption.

Besides this, the coloring matter is better extracted, and a great economy of labour is effected, as one man can effect two operations per diem.

Several precautions are necessary, in fact indispensable, to ensure complete success; for instance, the wood must be very evenly spread, in order that the resistance offered to the water may be equal throughout; and, for this purpose, the wood must be put into the vessel in small quantities at a time. A very important point is, to have the wood ground or rasped of a uniform size, without fine dust, as the particles of this latter are apt to adhere together, and offer great resistance to the water at certain parts; thus preventing the coloring matter from being extracted therefrom. I have found that the wood spreads much better by previously wetting it.

For some other woods, such as Lima and Pernambuco woods, and other red dyewoods, 600 quarts of water, instead of 450, must be employed, as the coloring matter is not so easily extracted. Quercitron cannot be operated upon, as it is too fine a powder. Cochineal does not succeed, as it swells so much on coming in contact with boiling water, that, in an experiment I made, I thought it would have burst the boiler.

This apparatus is, however, very advantageous for the woods above-mentioned, if the directions given are carefully followed.

ON THE EMPLOYMENT OF AMMONIACO-MAGNESIAN PHOSPHATE AS MANURE.*

BY M. BOUSSINGAULT.

AMMONIACO-MAGNESIAN PHOSPHATE contains the elements which appear to be the most necessary for the development of plants; it also possesses one of the properties belonging to gypsum, viz., a very slight degree of solubility.

On the 1st of May last, the author put a quantity of arable earth into stone vessels, capable of containing about nine square feet. These vessels were divided into two series; sixteen grammes of ammoniaco-magnesian phosphate were added to the earth contained in each of the first series, and in all the vessels a quantity of maize or Indian corn, which had already germinated was planted. All the vessels were placed out in the open air, and watered with an equal quantity of water when requisite.

During the first fifteen days after rising above the ground, all the plants presented the same appearance and vigour; it was only after the twenty-fifth day that a difference was perceived, and which was subsequently continued.

On the 25th July, the sprouts of the first series, which had been treated with the phosphate, were twice as high and three times as thick as those which had risen from the unprepared earth.

* *Newton's London Journal, or Repository of Art.*

On the 25th August, these proportions were different; the blades of the first being half as long again, and twice as thick, as the second.

All the blades were in ear at the same time; those which had been treated with the double salt bore three ears, two perfect and one imperfect; and the others only one perfect and one imperfect ear. The grain of the first weighed more than that of the second, in the proportion of two and a quarter to one.

ON THE PREPARATION OF A PURIFIED SOLUTION OF SHELL-LAC.*

BY DR. L. ELSNER.

From time immemorial cabinet-makers have employed a spirituous solution of bleached shell-lac for coating white woods with a polish. The bleaching of the shell-lac is generally effected on a large scale by chlorine or some of its compounds; and the bleached shell-lac then costs from 2s. 6d. to 3s. per lb., while excellent orange shell-lac may be had from 10d. to 1s. If the shell-lac which has been bleached by chlorine or its compounds or by sulphurous acid, contains but a small quantity of the body employed for that purpose, it frequently happens that on polishing furniture in which there are any inlaid metallic ornaments the latter become more or less tarnished. A method, therefore, for purifying the solution of the yellow shell-lac, without the employment of chlorine, sulphurous acid, or any similar substance, would have a two-fold advantage; in the first place, there would not be the least fear of injuring the metal; and in the second place, it would be far less expensive than the solution of the bleached shell-lac in spirits of wine.

To attain the object in view, I turned my attention to the application of charcoal, both animal and calcined vegetable. From a series of experiments, it became evident that the animal charcoal (granulated bone-charcoal) alone, was capable of yielding a practical and satisfactory result. For this purpose, equal quantities of light-colored shell-lac were dissolved in alcohol of 0·833 spec. grav. by digestion at a gentle heat, and the two different kinds of charcoal added respectively to the solutions; the digestion was now carried on for several days, and then the solution filtered through coarse blotting-paper. The solution which had been digested with animal charcoal had a light brownish color, was transparent and clear; maple, beech, and poplar were readily and beautifully polished by means of this solution, while that which had been digested with vegetable charcoal was of a darker color after filtration than before. The solution of the purified shell-lac may be readily prepared on a large scale in the following simple manner:—

Any quantity of yellow shell-lac, previously broken in small pieces, is conveyed into a glass flask, alcohol of 0·833 spec. grav. poured upon it, and the whole heated on the hob, or in summer in the sun, until the shell-lac is dissolved; upon this, so much coarsely-powdered animal charcoal (it must not be too fine, otherwise, on filtration, particles of the charcoal pass through the filter) is added to the solution so that the whole forms a thin paste. The flask is closed not quite air-tight, and left so for some time, exposed to the sun; and in 8 to 14 days a small sample is filtered to ascertain whether it has acquired a light yellowish-brown color, and whether it yields a clear, pure polish on light wood. If this be the case, it is filtered through coarse-blotting paper, for which purpose it is best to employ a tin funnel with double sides, similar to those employed in filtering spirituous solutions of soaps in the preparation of the transparent soaps, opodeldoc, &c. The space between the two funnels is filled with hot water, and the upper aperture covered with a tin lid. By this arrangement, the spirituous solution is kept warm, and does not stop up the pores of the paper; the tin cover prevents the evaporation of the spirit. The portion which first passes may be preserved separately, and be employed as a ground or first polish. Some more spirit is poured over the charcoal on the filter, and the solution used as a last coating.

The solution of shell-lac, purified by animal charcoal, has, it is true, a brownish-yellow color, but it is perfectly clear and transparent; when diluted with spirit, the color is so slight that it may be used in this state for polishing perfectly white wood, such as maple, poplar, and lime, without the wood acquiring the least tint of yellow. Several cabinet-makers of this town (Berlin), have employed the shell-lac polish thus prepared, and are perfectly satisfied with the results; I have also received a communication from Brunswick, stating that it has given general satisfaction.

* *Journ. für Prakt. Chem.*, xxxv. p. 374, and *Chemical Gazette.*

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

AN ESSAY ON ALCOHOLIC TINCTURES,

BY M. JACQUES PÉRSONNE.

(*Continued from page 87.*)

27. GINGER.

								grs.
1 pt.	15 grs	by 60 gr.	or 4	pts.	alco. at 80°	total extr.		0·54
	,,	60 ,,	4	,,	56 ,,			1·52
	,,	75 ,,	5	,,	id. ,,			1·55
	,,	75 ,,	5	,,	45 ,,			2·01
	,,	90 ,,	6	,,	id. ,,			1·80

This root owes its effects to a soft resin, on that account the Codex has directed the use of alcohol at 80° for this tincture. But if, on the one hand, we consider the enormous difference between the quantity of matter dissolved by alcohol of that strength, and alcohol at 56°; and, on the other hand, that this resinous matter may be perfectly removed by means of the extractive matter, alcohol at 56°, and 5 pts. of this solvent will be employed according to my plan, and this is the proportion also that takes up the greatest quantity of the soluble matter.

28. CINNAMON.

								grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco. at 80°	total extr.		2·61
	,,	75 ,,	5	,,	id. ,,			2·69
	,,	90 ,,	6	,,	id. ,,			2·73
	,,	60 ,,	4	,,	56 ,,			2·73
	,,	75 ,,	5	,,	id. ,,			2·60
	,,	60 ,,	4	,,	45 ,,			2·70
	,,	75 ,,	5	,,	id. ,,			2·72

The two last tinctures are so mucilaginous, they can scarcely be filtered.

As we see by this table, there is no great difference between the quantities of matter dissolved by alcohol of these different degrees of strength, but, considering that the weaker the alcohol is, the more mucilaginous the tinctures are, and that the active principle of this bark resides in its essential oil, I give the preference, as in the Codex, to alcohol at 80°; and rejecting the trifling excess of matter dissolved by six parts of this solvent, I should adopt the proportion of five parts.

29. SAFFRON.

								grs.
1 pt.	15 gr.	by 60 gr.	or 4	pts.	alco. at 80°	total extr.		8·10
	,,	60 ,,	4	,,	70 ,,			8·69
	,,	60 ,,	4	,,	56 ,,			9·06
	,,	75 ,,	5	,,	id. ,,			10·86
	,,	90 ,,	6	,,	id. ,,			10·80
	,,	60 ,,	4	,,	45 ,,			8·89
	,,	75 ,,	5	,,	80 ,,			8·71

The last two tinctures are very mucilaginous. We add, according to these experiments, that weak alcohol at 55°, extracts more from the saffron than alcohol at 80°; but, as it has been observed that a tincture prepared with weak alcohol, deposits, after a certain time, a considerable quantity of coloring matter, and—that it can, therefore, be no longer identical in composition, while that prepared with alcohol at 80°, is much more stable, I retain, according to the Codex, alcohol at 80°, for the preparation of this tincture, only I should employ five parts of this solvent, which is the proportion that produces the greatest quantity of extract from the same weight of the substance.

grs.

extr. 6·00
6·30
6·60
6·50
6·45
6·00
5·95

and transparent, in the resinoid mass floated, that these two alcohols had r quantity of the active much greater quantity of substances. I, therefore, employed in the Codex, s of this solvent would be to exhaust this substance, ss to the general rule, tion of 5 parts of alcohol, similar cases are too few

grs.

al extr. 2·22
2·67
3·03
3·25
3·18

tion adopted by the Codex great power of the medi- to ascertain what strength best. We see, according ted in this table, that pil- e given to alcohol at 60°, employment of this vehi- the Codex.

grs.

al extr. 4·12
3·57
3·06
4·18
4·38
4·50
4·23
4·18
4·26
2·32
3·25

se of alcohol of the same

number of substances, on experimented, amount to 32, experiments are sufficiently able me to draw the fol- from their results:—

CONCLUSIONS.

1. The degrees of strength of the alcohol prescribed by the Codex, are not always the most favorable for the solution of the largest quantity of the principles contained in the substances employed in the preparation of tinctures.

2. These degrees of strength can scarcely be admitted in a general manner, and by analogy, excepting in the case of a certain number of substances. Experiment alone can determine which is the best in each case.

3. The proportion of four parts of alcohol, for one of the substance employed in the Codex, is scarcely, in any case, sufficient to dissolve, entirely, the soluble parts of these bodies. The cases in which this proportion is sufficient are so rare as to prevent any generalisation.

4. The quantity of alcohol necessary entirely to exhaust a substance, is, in general, five parts of alcohol for one of the substance. In certain cases, however, but extremely rarely, this proportion is not quite strong enough, but the excess of matter dissolved is so trifling, that it may be left out of the question in laying down a general rule.

5. The quantity of alcohol is always sufficient to exhaust a substance, when that solvent is in sufficient quantity to cover it, and when the substance is herbaceous, as in the case of leaves.

6. The degrees of strength of the alcohol, which I have found most adapted for the preparation of different tinctures, are 80°, 56°, and 45°.

We shall find these different degrees of strength arranged in the following table, along with the substances for which they are adapted. I have also added, in the case of each of these tinctures, the quantity of substance equivalent to 1 gramme of the tincture.

Before I conclude I must mention a singular fact, which, as we may perceive, presented itself in almost every experiment: in almost every instance when the proportion of alcohol was too great, I always obtained less extract than when it was just enough; that is to say, the more I increased the quantity of the alcohol, the more the quantity of extract was decreased.

This fact, analogous to that which I have often observed, when water is added to a concentrated solution of opium, when we see substances precipitated that were previously held in solution; this fact, I say, sufficiently proves, that there is a great inconvenience in too much increasing the proportion of alcohol in the preparation of tinctures; for, besides that, the density of the tincture would be diminished by this addition of alcohol, it would be still more so, by the precipitation of a certain quantity of matter, as occurs in the case of the solution of opium.

A TABLE OF THE DIFFERENT STRENGTH OF ALCOHOL TO BE EMPLOYED IN THE PREPARATION OF EACH SUBSTANCE.

We prepare, with 1 part of the substance and 5 parts of alcohol at 80°, the tinctures of—

Yellow bark	1 gr.	of tincture, equal, to	0·20 in powder.
Jalap	1 gr.	,,	0·19 ,,
Cinnamon	1 gr.	,,	0·20 ,,
Pellitory of Spain	1 gr.	,,	0·20 ,,
Saffron	1 gr.	,,	0·17 ,,
Castoreum	1 gr.	,,	0·18 ,,
Myrrh	1 gr.	,,	0·19 ,,

1 part of the substance and 5 parts of alcohol at 56° for the following tinctures:—

Rhubarb	1 gr.	of tincture, equal to	0·18 in powder.
Wormwood	1 gr.	,,	0·19 ,,
Gray bark	1 gr.	,,	0·20 ,,
Ipecacuanha	1 gr.	,,	0·19 ,,
Nux vomica ...	1 gr.	,,	0·20 ,,
Gentian	1 gr.	,,	0·18 ,,
Red bark.....	1 gr.	,,	0·20 ,,
Foxglove	1 gr.	,,	0·18 ,,
Senna	1 gr.	,,	0·19 ,,
Squills.....	1 gr.	,,	0·17 ,,
Black hellebore ..	1 gr.	,,	0·18 ,,
Root of azarum ..	1 gr.	,,	0·19 ,,
Contrayerva	1 gr.	,,	0·20 ,,
Milkwort	1 gr.	,,	0·18 ,,
Ginger.....	1 gr.	,,	0·20 ,,

According to the Codex, 8 parts of alcohol at 56° are required for tincture of cantharides.

We prepare, with 1 part of the substance, and 5 parts of alcohol, at 45°, the following tinctures:—

Valerian root	1 gr.	of tincture, equal to	0·19 in powder.
White hellebore	1 gr.	,,	0·18 ,,
Bulbs of meadow saffron	1 gr.	,,	0·19 ,,
Leaves of azarum	1 gr.	,,	0·19 ,,
Wolf'sbane	1 gr.	,,	0·19 ,,
Hemlock	1 gr.	,,	0·18 ,,
Belladonna	1 gr.	,,	0·19 ,,
Henbane	1 gr.	,,	0·18 ,,
Strammonium	1 gr.	,,	0·18 ,,

As to the mode of preparing these tinctures, I think experience has sufficiently proved that of all the plans proposed, cold maceration is the best.

THE QUANTITIES OF MEDICINAL HERBS SUPPLIED TO THE LONDON MARKET.

	FROM MITCHAM.		FROM OTHER PLACES.	TOTAL.
	Average of 3 years, 1840-41-42.	Average of 3 years. 1843-44-45.	Average of 3 years, 1843-44-45.	Average of 3 years, 1843-44-45.
Camomile flowers	12 tons	4 tons	16 cwt.	4 tons 16 cwt.
Red-rose petals	5000 lbs.	2200 lbs.	——	2200 lbs.
Poppy capsules, whole	350,000	200,000	750,000	950,000
,, ,, broken	4 tons	2 tons	2 tons	4 tons
Liquorice root	30 tons	12 tons	3 tons	15 tons
Angelica root	2 tons	5 cwt.	5 cwt.	10 cwt.
Henbane plant	6 tons	5 tons	15 tons	20 tons.
Belladonna plant	4 tons	2½ tons	3½ tons	6 tons.
Stramonium	16 cwt.	4 cwt.	18 cwt.	22 cwt.
Aconite	12 cwt.	7 cwt.	14 cwt.	21 cwt.
Savine	25 cwt.	25 cwt.	——	25 cwt.
Wormwood	10 cwt.	10 cwt.	1 ton	1¼ ton.
Rhubarb root	——	——	20 tons from Banbury.	20 tons.

AN EASY METHOD OF ASCERTAINING THE GENUINENESS OF GUAIACUM WOOD.*

BY J. H. SCHWACKE.

When a few drops of a solution of perchloride of mercury are poured over some shavings of guaiacum wood in a test-tube and slightly warmed over a spirit-lamp, a bluish-green colour is immediately produced with all genuine samples. This test is easier than that by means of nitrous vapours, and is probably owing to the same cause as the blue colouring of guaiacum wood described by Schacht.

* *Archiv der Pharm.*, xliv. p. 178.

NOTICE ON THE APPLICATION OF THE SPHEROIDAL STATE TO THE ANALYSIS OF THE SPOTS PRODUCED BY MARSH'S APPARATUS.*

BY M. BOUTIGNY.

A spot produced by Marsh's apparatus being given, to ascertain whether it is arsenical or not?

The solution of this problem by the old analytical process is almost impossible: but by having recourse to the following artifice we may easily show whether the spot is occasioned by arsenic:—

* *Comptes Rendus.*

We first circumscribe it with a glass rod, previously moistened with water containing $\frac{1}{100}$th of pure nitric acid; we then allow a drop of the same acid to fall upon it, so that it shall not be in contact with more than about one milligramme of the real acid. We warm it gently, and, if the spot is arsenical, it disappears almost immediately: it is then transformed into arsenious and arsenic acids. We allow the capsule to become cold, and then direct a current of hydrosulphuric acid, arising from the decomposition of water over the sulphuret of iron, by means of sulphuric acid, on the place where the spot was found, and a yellow spot will soon appear where the original shining mark was seen, if the spot be arsenical.

The disengagement of hydrosulphuric acid from the sulphuret of iron is a condition indispensable to success. That which arises from the action of sulphuret of antimony on hydrochloric acid, as it always deposits sulphur, would destroy the precision of the ulterior reactions.

The yellow spot obtained in the manner I have described above is dissolved in 1 gramme of very pure liquid ammonia; a platinum capsule is made red-hot, and we pour into it, drop by drop, the colourless ammoniacal solution, which passes into the spheroïdal state. It forms a very flat spheroïd, the horizontal diameter of which constantly diminishes, its axis, or vertical diameter, remaining unchanged. When the spheroïd is transformed into a sphere, and it is not larger than a small pea, you touch it with a tube moistened in hydrochloric acid, and the spheroïd, from being colourless as it was, becomes yellow; we allow a drop of ammonia to fall upon it, and it loses its colour to become again yellow when touched with hydrochloric acid.

These changes from a colourless to a coloured state may be produced almost indefinitely. This is a characteristic that belongs exclusively to sulphuret of arsenic, which has an analogy in regard to colour with sulphuret of cadmium; but the latter being insoluble in ammonia, the two sulphurets cannot be compounded, and error is impossible. When the preceding re-actions have been carefully obtained, a small crystal of carbonate of soda, weighing 0·05, is placed in the spheroïd; the capsule is withdrawn from the action of heat, and placed on a flat metallic surface, the temperature rapidly falls, and the spheroïd spreads itself out almost immediately on the most inclined part of the surface. The small saline mass is then carefully collected, and placed at the bottom of a closed tube, the part containing the salt is brought to a red heat, holding the tube in a horizontal position, and almost immediately there appears on the upper side of the tube that which was first seen on the capsule.

The tube being cold, it is divided so as to separate as nearly as possible the part on which the spot is placed; we then pulverize it in an agate mortar, and project it on a large piece of strongly ignited charcoal. You bend your head over the charcoal at the distance of 20 or 30 centimetres, and the garlick-like smell of arsenic is perceived, then there can be no further doubt the spot is arsenical.

This last experiment must be made in a closed room, to avoid the currents of air that might drive off the arsenical vapours.

I had already, at a former time, applied the spheroïdal state to the analysis of a microscopic spot of blood. M. Chambert did the same by employing water in the spheroïdal state as an agent of combustion, to consume the organic matters contained in salts, obtained by the evaporation of urine, and I have no doubt that before long I shall be able to cite other important results obtained by the study of matter in a spheroïdal state.

OBSERVATIONS ON A NEW SUBSTANCE BROUGHT FROM AMERICA.*

BY M. GUIBOURT.

In the month of August last, M. Leroy, a pharmacist at Brussels, sent me a volatile oil, very remarkable, on account of its flowing abundantly from a vegetable, without its being necessary to have recourse to distillation to obtain it. I much regret that I have neglected this communication up to the present time. At Bogota, from whence it is brought, this oil is called *aceite of copaiba*. The tree that produces it is at present unknown, but it grows abundantly in the moist virgin forests in the neighbourhood of Bogota; it contains so large a quantity of the essence, that it is sufficient to wound a branch, and suspend a vessel from it, to collect a litre in a very few minutes.

This essence is liquid, of a very pale yellow colour, not greasy to the touch, its taste is sweet at first, then hot, pungent, and bitter. Cold, a few degrees above the freezing point, does not render it solid. Its smell, according to M. Leroy, much resembles that of orange blossoms, but to me it appeared more like that of the rose, or rather the essence of *licari*, rosewood. M. Guibourt, to

* *Journal de Pharmacie*, Feb. 1846.

whom I showed it, told me that this essence came from forests situated about seven or eight leagues from Bogota, but he was not acquainted with the tree that produced it, and that it was employed at Bogota in the adulteration of copaiba. It is, in fact, certain that the copaiba that reaches us from Maracaibo and other parts of Columbia, much resembles it in smell; this, up to the present time, has been attributed to it, solely, on the ground that it was produced by a particular species of *copaifera*.

A SUBSTITUTE FOR THE COMMON BLACK DRAUGHT.

℞—Potassio-tartrate of soda.. 1 drachm;
Compound senna liquor, 2 or 3 drachms;
Water, ... 1½ oz.;
Aromatic spirit of ammonia, 10 minims.

A teaspoonful of this liquor is an admirable purgative for children; and no child, however averse to medicine, will hesitate to take it, from anything connected with its taste.

STYPTIC LOTION OF BROCHIERI.*

℞—The wood of the fir, cut small and bruised ..... 1 part.
Water ..... 2 parts.

Let it macerate for 12 hours, and distil over a portion of the product. It is then left at rest for 24 hours, and we remove the essential oil. This water must be shaken before used.

HEMOSTATIC WATER OF NELJABIN.†

	Grs.
℞—Siberian castorium	30
Ambergris	30
Ergot of rye	125
Balsam of Mecca	12
Canada balsam	60
Cinnamon	420
Rosemary flowers	750
Sprigs of peppermint	360
Calcput oil	15
Rectified alcohol	500
Water	q. s.

Bruise or cut all these substances; let them macerate for twelve hours in the alcohol and water, and distil so as to pass over 3·750 parts of the product.

* *Arch. de Pharm.*
† *Ibid.*

COD-LIVER OIL IN CHRONIC RHEUMATISM.*

Dr. Bradshaw describes several cases of chronic rheumatism, some of which were severe, in which a cure was effected by the exhibition of train oil internally, in doses gradually raised from a teaspoonful to a wineglassful three times a day. He believes that the remedy acts beneficially by its stimulating effects. He considers the fine-drawn blubber oil obtained from the whale, when obtained pure, to be quite as efficacious as that procured from the cod's liver. He is in the habit of administering the remedy in various vehicles, as circumstances require, or the condition of the patient demands, such as cinnamon and peppermint waters, thin gruel, milk, and the alcoholic potions, but gives the preference to a thin infusion of linseed, flavoured with lemon peel, and sweetened to please the palate. The mode of giving the oil with this, is in form as follows:—A small quantity of infusion is poured into a glass, to which is added the oil, and again another small quantity of infusion upon it. In this manner the dose may be taken, and will slip down without offending the palate, and generally is well retained even by irritable stomachs. Another mode has been successful where many have failed, and will be found equally valuable; it is the yolk of an egg beat up with boiling water and sugar, with which may be mixed a dessertspoonful of brandy, and on this the dose may be given without producing that nausea so frequently experienced when conveyed by other vehicles.

THE QUANTITY OF LEECHES IMPORTED INTO FRANCE IN 1844.†

BY M. VIREY.

German association, including Hungary	4,170,800
Belgium	278,000
Hanseatic towns	251,000
England	679,500
Spain	610,950
Sardinian States	5,134,123
The two Sicilies	4,000
Switzerland	404,500
Turkey, in Europe and Asia ..	2,133,700
Barbary States	352,800
Algeria and Kabylia.....	1,219,100
United States of America	3,000
	15,232,673

* *Provincial Medical Journal.*
† *Jour. de Pharmacie*, Feb. 1846.

Gerhardt, and ought to be replaced by $C^{18}\ H^{16}\ O^{3}$, which expresses the results of their analyses.*

The caustic, or carbonated alkalies, readily dissolve cetraric acid; the solutions being insupportably bitter, and then become changed by degrees, by exposure to air.

The ammoniacal solution is yellow, and is decomposed much more rapidly than those of potash and soda.

To obtain cetrarate of ammonia in a state of purity, it is best to act on the acid by means of ammoniacal gas. In this manner we obtain a yellow powder, it having absorbed 10·2 per cent. of ammonia: this quantity corresponds with a neutral binammoniacal salt.

The solution of this salt yields with acetate of lead a yellow and flocculent precipitate, which authors represent by $C^{18}\ (H^{14}\ Pb^{2})\ O^{8}$, but which is evidently $C^{18}\ (H^{14}\ Pb^{2})\ O^{17}$, that is to say, neutral biplumbic cetrarate.

The cetrarate of silver is a yellow precipitate, which soon turns brown.

LICHENSTEARIC ACID.

This substance, is a pale acid, which is exhibited under the form of perfectly white and pearly crystals. It has no smell, but is of an acrid and rancid taste—not bitter. It is quite insoluble in water; alcohol readily dissolves it, particularly when hot, and deposits it, as it becomes cold, in oblique, quadrangular tables. Ether and the essential oils also dissolve it.

It melts at about 248°F. into a limpid oil, which hardens, as it cools, into a crystalline mass.

Messrs. Schnedermann and Knop represent it by the formula $C^{29}\ H^{50}\ O^{6}$, which appears to me to be no more correct than the preceding; the proportions $C^{15}\ H^{26}\ O^{3}$ seem to me to be more probable.†

This acid is readily dissolved by the alkalies; the solutions undergo no change by exposure to the air.

The lichenstearate of potash is obtained in viscous flocks, which, dried and dissolved in alcohol, yield a crystalline powder.

The solution of the preceding salt yields a grayish-white precipitate, which is gradually discoloured by the action of light. This product is decomposed at 312° F., giving out a rancid odour. Messrs. Schnedermann and Knop represent it by $C^{29}\ (H^{49}\ Ag^{2})\ O^{6}$; but they have made but one determination of the silver that agrees better with the formula,* $[C^{15}\ (H^{29}\ Ag)\ O^{5}]$. The salt of soda is obtained in white grains.

The salt of lead is obtained as a white flocculent precipitate, which becomes plastic by the action of heat.

The salt of baryta comports itself in a similar manner. The formula adopted by the authors requires the same corrections as the preceding; even they themselves have no great confidence in these formulæ, and they propose to return to them by making fresh experiments.

We shall not follow these gentlemen by enumerating their endeavours to isolate from Iceland moss, another substance, which accompanies the preceding acids—the nature of which they have not succeeded in defining; we shall also pass over in silence some vague indications of the amylaceous substances, the existence of which in the lichen had been previously discovered by M. Müller.

* The analyses of Messrs. Knop and Schnedermann were calculated from 75·12 for the carbon, and gave 60·25—60·06—60·05 carbon; 4·63—4·64—4·71 hydrogen; with 75, we have the formula I propose, 60·0 carbon, and 4·4 hydrogen.—C. G.

† The analyses given by chemists give carbon, 70·4; hydrogen, 10·1. The formula $C^{14}\ H^{24}\ O^{3}$, corresponds with carbon, 70·0; hydrogen, 10·0. $C^{15}\ H^{26}\ O^{3}$ corresponds with carbon, 70·8; hydrogen, 10·2. This last, therefore, appears probable.—C. G.

OBSERVATIONS ON A NOTE OF M. ELSNER.†

BY M. A. LEVOL.

According to M. Elsner,‡ the process I have described for separating antimony and tin from each other, is not correct, because the boiling hydrochloric acid dissolves a portion of the antimony. Nevertheless, in the present instance, after the numerous experiments I have made, I cannot explain the assertion of M. Elsner, unless I suppose he thought it necessary to wash the metals precipitated by the zinc, and consequently eliminate the chloride of that metal which remains after the compound precipitation of antimony; a condition which, in fact, allows the hydrochloric acid to act on the antimony, but it is not the same in the presence of chloride of zinc. It is of great importance, therefore, not to remove it, I have so laid it down in my note, inserted in the *Annales de Chimie et de Physique*; where it will be perceived

* An alysis has given 29·6 per cent. ofthe metallic silver: my formula is 29·9 per cent.—C. G.

† *Journ. de Phar.* Feb. 1846.

‡ See page 56 of s volume.

that the manipulations are considerably simplified, which is another advantage.

Perhaps it will not be out of place, to observe, on this occasion, that in the process of M. Chaudel, the accuracy of which I believe no one has up to the present time contested, it is the presence of a large proportion of chloride of tin that prevents the dissolution of the antimony, and in my method it is that of the chloride of zinc. M. Chaudel clearly perceived this peculiarity, nearly thirty years ago; he even endeavoured to explain it, and if I also may be allowed to risk an explanation, I should say, that when hydrochloric acid is added in a certain proportion to chlorides of tin or zinc, it appears to me that it ought to be considered as combined with those chlorides, it would, in that case, not have a perfect freedom of action, and would form, with them, hydrochlorates of chlorides, or double chlorides of hydrogen and tin, or zinc, not capable of being decomposed by antimony, but convertible into simple chlorides by tin.

I think I ought to profit by this circumstance, to protest against the modification my process was made to undergo, after having explained it in the *Revue Scientifique*, (in the number for Feb. 1845.) It is to be feared that this modification, evidently made without experiment, and adopted by M. Elsner, as an improvement, prevented his obtaining a correct result.

SOME EXPERIMENTAL RESEARCHES TENDING TO DISPROVE THE EXISTENCE OF PROTEIN.*

BY BARON LIEBIG.

ON THE SUPPOSED BINOXIDE OF PROTEIN.

ACCORDING to Bouchardat, if moist fibrine be immersed in water acidulated with a two-thousandth part of hydrochloric acid, the fibrine speedily becomes gelatinous, and on continuing the action of the dilute hydrochloric acid, a solution is obtained, which is turbid. This turbidity appears to arise from a slight admixture of a fatty substance. That portion of the fibrine which is thus soluble in hydrochloric acid, Bouchardat designates by the term ALBUMINOSE, the insoluble part by that of EPIDERMOSE.

Mulder states that this experiment was repeated by Herr Von Baumhauer. The solution of fibrine in dilute hydrochloric acid, Baumhauer precipitated by means of carbonate of ammonia, and treated the precipitate with alcohol. After drying, the precipitate yielded on analysis—

	I.	II.
Carbon.....	53·64	55·62
Hydrogen ..	6·88	6·73
Nitrogen	15·88	—
Oxygen	23·64	—

M. Mulder concludes, from these experiments, that "the albuminose is a product of the oxidation of protein, which, no doubt, is formed by the action of the atmospheric oxygen upon the matter formed and dissolved by the hydrochloric acid. It is *binoxide* of protein = $C^{40} H^{62} N^{10} O^{14}$."

We have of late been so overwhelmed with descriptions of substances, which, although greatly differing in their properties, yet, according to their analyses, must be considered as oxides of protein, that I was very desirous of convincing myself, by experiment, of the existence of at least one of them.

I have found, that if we are to understand by the designation, *binoxide of protein*, a substance which contains no sulphur, the substance investigated by Baumhauer cannot belong to such a class of bodies as oxides of protein, since the whole amount of sulphur present in fibrine exists unaltered in this new substance.

In the first place, I have observed that the atmosphere and its oxygen have no share in the solution of fibrine in hydrochloric acid. If moist fibrine is allowed to become gelatinous in dilute hydrochloric acid, and the mixture copiously diluted with water, and immediately afterwards filtered, before the solution has taken place, the presence of lime and potass may be detected in the filtered fluid. If the fluid be exposed to the protracted action of a higher degree of heat so as to effect the solution, and a portion of this heated to boiling, with an excess of potass, the subsequent neutralization with acetic acid gives rise to a copious evolution of sulphuretted hydrogen, and a drop of acetate of lead produces in it a black precipitate. Upon solution of fibrine in dilute hydrochloric acid of the above given strength, therefore, the sulphur remains combined with the other elements of the fibrine. If this solution of fibrine in hydrochloric acid (the albuminose of Bouchardat) is mixed with a solution of common salt, sulphate of soda, or nitrate of potass, the mixture coagulates, forming a caseous or albuminous mass, which may be washed with a solution of common salt, the fluid which runs off containing common salt, contains no longer any perceptible traces of lime or phosphoric acid: these two substances are, however, contained in the pre-

* *Lancet*, Feb. 21, 1846.

cipitate. The fluid contains no oxygen compound of sulphur, and gives no reaction of sulphuret of potassium when boiled with potash ley. But, according to Mulder, the albuminose of Bouchardat is binoxide of protein; were it so, the precipitate ought to contain neither phosphate of lime nor sulphur; but on dissolving it in potash ley, and boiling, and adding, subsequently, salts of lead, a black precipitate of sulphuret of lead is produced, and the action of acid produces an evolution of sulphuretted hydrogen.

This substance is, therefore, not a binoxide protein.

ON THE PRESENCE OF SULPHUR IN THE NITROGENOUS CONSTITUENTS OF PEAS.

Mulder says, p. 307 of his "Physiological Chemistry"—"According to Rochleder, legumine and casein stand in close affinity to one another, and differ only in their respective reactions with acetic acid. Rochleder made his analysis, however, not with legumine, but with protein prepared from legumine. He dissolved legumine in concentrated potass ley, filtered the solution, and precipitated the filtrate subsequently with acetic acid. This is no longer legumine, but protein, free from sulphur, and contaminated with an extraneous substance, the admixture of which lowers the proportion of nitrogen and carbon by about one per cent. The composition of legumine, therefore, is unknown. Rochleder states legumine to contain a certain proportion of a substance insoluble in potass and in ammonia, and, moreover, an admixture of sulphur. The latter statement is incorrect with regard to legumine obtained from almonds and peas, since this contains free sulphur."

If, with MM. Dumas and Cahours, we call legumine the nitrogenous substance which these chemists prepared from almonds, this legumine differs from the body prepared from the beans which Rochleder analysed, not simply in as much as the former is soluble in acetic acid, whilst the latter is insoluble in this menstruum, but, moreover, in this, that the legumine prepared from almonds contains eighteen per cent. of nitrogen, whilst that prepared from beans and peas contains only 15·78 per cent. of this element. If fibrine, albumine, or casein, are dissolved, as Mulder states, in moderately concentrated potash ley, and the solution is subsequently neutralized with acetic acid, the precipitate produced is *not* protein free from sulphur, as Mulder believes. I, myself, have examined a solution of this kind, and I found that it does not turn black when mixed with solution of sugar of lead, and consequently contains no sulphuret of potassium; and, also, that acetic acid evolves no sulphuretted hydrogen from it. If the white precipitate produced by the addition of acetic acid to the solution is washed and subsequently dissolved in potash, and the solution is then boiled, the addition of a drop of solution of sugar of lead imparts an inky tint to the fluid, owing to the formation of sulphuret of lead. The precipitate, consequently, is not protein. This deportment, therefore, does not warrant the conclusion that the substance which Rochleder analysed was sulphate of protein.

If soaked and finely-bruised peas, stirred into a thin paste with ammoniated water, be passed through a filter, and the filtrate be precipitated with acetic acid, the precipitate produced, subsequently dissolved in potash ley, and the solution boiled, supersaturation with an acid will give rise to a copious evolution of sulphuretted hydrogen, and the addition of salts of lead will produce a precipitate of sulphuret of lead.

The nitrogenous constituent of the pea, to which I assigned the name of vegetable casein, is, therefore, not free from sulphur, as Mulder maintains. That this substance does not differ in composition from other nitrogenous and sulphuretted vegetable substances is sufficiently proved by the simple fact that peas contain everything requisite for the formation of the blood, and consequently for the sustenance of life. If the nitrogenous constituent of the pea were free from sulphur, how could it form blood, fibrine, and albumine? It is my opinion, moreover, that the mode of formation of proteine requires a new and more searching investigation. I have not succeeded as yet in producing a non-sulphuretted substance possessing the composition and properties of the so-styled protein, according to the data and instructions given by Mulder.

Might it please M. Mulder to give a minute and circumstantial description of his process."

NOTE ON THE LIBERATION OF ELECTRICITY, WHICH TAKES PLACE IN THE EXPERIMENT OF THE BURST BLADDER.*

BY J. DUPREY.

THE experiment of the burst bladder, which is introduced in lectures on physics in evidence of the pressure which the air exercises on bodies, is well known; but the point which, as far as I am aware, does not

* *Electrical Magazine.*

appear to have been hitherto observed, is a liberation of electricity which occurs in the same experiment. This liberation may easily be proved by employing, as the receiver of the bursting bladder, a glass cylinder from 20 to 30 centm. (8 to 12 in.) high, and 10 to 15 centm. (4 to 6 in.) in diameter. Half way up, the side of the cylinder is pierced with a hole, in which is cemented a copper conductor, 3 or 4 decim. (12 to 16 in.) long. At one extremity of this conductor, that which is placed in the interior of the cylinder, and nearly in the axis of the latter, is screwed a small ball, also of copper, 3 or 4 centm. (1½ in.) in diameter, and the other extremity is bent so as to be able to be plunged into the mercury of a small cup, terminating the stem of a gold leaf electroscope, and which is intended to establish a perfect communication between that instrument and the conductor.

The apparatus being thus prepared, a membrane of bladder is stretched upon the cylinder, and, after it has been allowed to dry, the cylinder is placed upon the plate of an air pump, care being taken to place the conductor in communication with the mercury contained in the cup of the electroscope; the vacuum is then made. At the moment when the membrane bursts, the gold leaves of the electroscope, even though their length exceeds 7 centm. (3 in.) are projected against the armatures of the instrument by the electricity that is set free. It sometimes happens in this experiment that the membrane, presenting too much resistance, does not burst when the vacuum is carried as far as the air-pump permits, but then a gentle blow given to the membrane with the slightly-roughened end of a glass rod is sufficient to make it burst. In all cases, the electricity with which the electroscope is charged is positive.

It is well known that in England, Mr. Armstrong and Mr. Faraday have obtained electricity by allowing air to pass out of a vessel in which it had been strongly compressed. According to Mr. Faraday, this electricity is to be attributed to the friction which the vapour of water, contained in the compressed air, and condensed by the expansion of the latter, exercises against the side of the escape orifice, or against bodies placed in its course. It was while desirous of repeating some of Mr. Faraday's experiments, but with air subjected merely to the pressure of the atmosphere, that the idea occurred to me of making the experiment of the burst bladder. It was, therefore, natural, at first sight, to regard the electricity, that is liberated in this experiment, as produced by the same cause as that to which the electricity observed in Faraday's experiments is due; and this with the more reason, as I had already, in another experiment, obtained electric signs by allowing the air to return again into a glass globe in which a vacuum had been made. However, experience and reflection soon taught me that it was not so. In fact, it is not in the friction exercised by the particles of water contained in the air against the side of the conductor, placed in the interior of the recipient of the burst bladder that the cause of production of electricity resides; for if, in order considerably to diminish this friction, this part is replaced by a very fine copper wire soldered to the conductor, we observe that the electricity with which this wire becomes charged at the moment when the membrane bursts, is equally strong with that which is obtained with the part of the conductor terminated in a ball. On the other hand, the large opening of the receiver no longer permits us to entertain the opinion that the electricity would arise from the friction exercised against the receiver itself. Finally, it is difficult to suppose that the quantity of water produced by the sudden condensation of the vapour contained in the air, is sufficient to produce by friction an electricity so powerful as that attested by the divergence of the gold leaves of the electroscope.

It is elsewhere, therefore, than in the friction of the particles of water, either against the conductor or against the receiver, that we must seek for the cause of this electricity. With this view the following experiment may be made:—One end of a small piece of tin-foil, a few centimetres in width, is fixed, by means of a little gum arabic, to the membrane of the bladder that is stretched over the receiver, and near to the edge of the latter; the other extremity of this tin-foil is tied round a small bent wire of red copper, which is plunged into the mercury cup of an electroscope. The conductor of the receiver is then made to communicate with a second electroscope; after which the vacuum is made in the receiver. At the moment when the membrane bursts, the two electroscopes diverge powerfully; the one which communicates with the conductor of the receiver is charged, as usual, with positive electricity, whilst the other—namely, that which communicates with the membrane, is charged, on the contrary, with negative electricity.

It follows, from this experiment, that the cause of the liberation of the electricity resides at the entrance of the receiver; and as the parts of the membrane of bladder, which remain adhering to the side of the receiver, possess negative electricity, it is to be

presumed that those which are carried away, and projected into the receiver, possess the contrary electricity, and that they communicate this electricity to the conductor which they meet. This supposition is verified directly by experiment. A membrane of bladder is stretched over the receiver, and by means of the slip of tin-foil already described, it is put in communication with an electroscope. A little rent is produced in this membrane, and, by means of a small pair of insulated pincers, a part of this membrane is rapidly torn away at the moment the leaves of the electroscope present a negative divergence. If the torn part of the membrane be presented to a second electroscope, the leaves of the latter immediately diverge with positive electricity. This latter experiment evidently shows that the electric effect obtained in the experiment of the burst bladder, is produced by the destruction of the molecular attraction of the parts of the membrane of the bladder, and that it is analogous to the electrical effects which occur in the cleavage of certain bodies.

A NEW TEST FOR MANGANIUM.

BY MR. REUBEN PHILLIPS.

Place the solution of manganium in a bottle, so that it may cover the bottom of the phial to the depth of about the tenth of an inch, and lay in the fluid a common stick of phosphorus, by which means one half of the stick will be exposed to the air; the mouth of the bottle should be but imperfectly closed. After keeping the bottle in the dark for a few hours, the fluid will be found to possess a beautiful amethystine tint; by exposure to the light of the sun, the fluid soon becomes colourless; but the colour may be again renewed by placing the bottle in the dark.

In this instance, the formation of permanganic acid does not appear to be due to the direct action of ozone on the metallic solution; for when the ozone was prepared in one vessel, and conducted into another containing a solution of sulphate of manganium, the hydrated peroxide of manganium alone was at first obtained: subsequently, the fluid acquired a very slight tinge from the permanganic acid. From this, I am inclined to believe that in the former experiment, the permanganic acid is developed by the action of the acids of phosphorus on the hydrated peroxide of manganium.

It is premature, perhaps, to speculate on the formation of ozone by phosphorus; but I cannot help thinking the action will turn out to be the following:—

The experiments of M. Wurtz have very satisfactorily demonstrated the existence of hydrogen in the radical of the phosphorus acid, which may be thus represented: $(POH)+H^2=PHO^4$ 2HO; two equivalents of the oxygen may reasonably be supposed to enter and complete the radical simultaneously with union of the radical with the basic hydrogen, both of which are supplied by two equivalents of water; but phosphorus acid also contains four more equivalents of oxygen, and one equivalent of hydrogen, not basic. If, now, these four equivalents of oxygen come from the free oxygen surrounding the phosphorus, and the equivalent of hydrogen from the water, then we have an equivalent of oxygen which may combine with water, producing ozone.

SOME RESEARCHES ON ANILINE.*

BY A. W. HOFMANN.

In my former papers on aniline I had repeated opportunities of pointing out the remarkable analogy which exists between this body and ammonia, and at the conclusion of my memoir on chloranilin and bromanilin, I announced the existence of a compound which may be considered as urea, in which ammonia is replaced by aniline.

The discovery of this substance opened a new field for research, inasmuch as it was to be expected, that all the relations exhibited by ammonia, and the metamorphoses it undergoes, might be realised with aniline.

A short time after this communication, M. Gerhardt, in proceeding in this direction, prepared some products belonging to the same series, which are formed when oxalate of aniline is subjected to dry distillation, or when chloride of benzoyle is acted on by aniline. I have also prepared these bodies, but shall not enter into details upon them in this preliminary note, in which I intend to describe some further results at which I arrived.

The action of the vapours of cyanic acid upon aniline is rather complicated. A normal cyanate of aniline (urea of aniline) is best prepared by mixing a solution of sulphate of aniline with cyanate of potassa. The liquid after the lapse of a few moments, becomes turbid, and in an hour the whole solidifies into a crystalline mass. By simple recrystallisation from water, the new compound is obtained in a state of perfect purity.

* *Lancet*, Feb. 21, 1846.

The combustion of this substance furnished results corresponding to the formula—

$C^{14} H^3 N^3 O^3 = C^{12} H^7 N, HO, CyO,$

i.e., urea, in which the ammonia is substituted by an equivalent quantity of aniline.

From the properties of this compound, it is evident that the elements of aniline and cyanic acid undergo a similar transposition to that of the same acid and ammonia, when forming urea.

The body,

$C^{14} H^8 N^2 O^2,$

is not the ordinary cyanate of aniline; it crystallises, without change, from a concentrated solution in potassa, and its acids disengage neither cyanic acid nor carbonic acid.

The comportment of aniline with cyanic acid, induced me to subject it to the action of cyanogen, and chloride of cyanogen. In these reactions a series of new crystalline compounds is obtained, which are still under examination.

Not less remarkable is the action of sulphide of carbon upon aniline. When left in contact for some time with this compound, aniline, with evolution of hydrosulphuric acid, is converted into a white crystalline mass, which is difficultly soluble in alcohol, and may be purified with great facility. The analysis of this new compound yielded numbers corresponding with the following formula:—

$C^{13} H^6 N S,$

i.e., aniline, which has lost one equivalent of hydrogen, and has assumed in its place a compound of carbon and sulphur, C S, which corresponds in composition to carbonate oxide.

Aniline..... $C^{12} H^7 N$

Sulphocarbanilide $C^{13} H^6 N C S.$

This peculiar compound, which is neither acid nor base, is likewise obtained in a most interesting transformation—*i.e.*, the decomposition of sulphocyanate of aniline by destructive distillation.

The sulphocarbanilide, as we may provisionally term this compound, is only slowly changed by re-agents. The continued action of an alcoholic solution of potassa, however, decomposes it. After boiling three or four times, the solution contains a large proportion of sulphide of potassium, and on cooling, deposits a substance crystallising in large brilliant needles, which is a new compound.

By analysis, the numbers obtained gave the following formula:—

$C^{13} H^6 N O,$

which shows that these crystals are formed simply by an exchange of the sulphur of the compound with the oxygen of the potassa.

Other oxides produce the same effect as potassa. On boiling sulphocarbanilide with oxide of mercury, the red colour soon disappears, black sulphide of mercury being formed.

According to the above formula, this new substance, which is also an indifferent body, may be considered as aniline which has lost one equivalent of hydrogen, and assumed the elements of carbonic oxide.

Aniline..... $C^{12} H^7 N$

Carbanilide..... $C^{13} H^6 N O O;$

and this view suggested to me at once another experiment, which was successful.

If the above given formula expresses the true composition of this substance, if it be indeed carbanilide, it was extremely probable, if not certain, that it might be produced by the direct action of chlorocarbonic acid (phosgene gas) upon aniline.

$$\underbrace{C^{12} H^7 N}_{\text{Aniline}} + \underbrace{C\,O\,Cl}_{\text{Phosgene.}} = \underbrace{C^{13} H^6 N O}_{\text{Carbanilide.}} + H\,Cl.$$

On introducing aniline into a balloon filled with chlorocarbonic acid, the glass became so hot that it burst. On cooling, the liquid solidified into a white crystalline mass, which, by the action of water, was resolved into hydrochlorate of aniline and carbanilide.

This is, indeed, a far easier way of obtaining this substance in a state of purity.

On mixing aniline with oil of mustard, at first no change was observed. After the lapse of some months, however, the solution had deposited splendid four-sided tables, constituting evidently the compound corresponding to thiosinnamine.

When brought in contact with tritochloride of phosphorus, or chloride of silicon, aniline is likewise converted into crystalline compounds.

ON A NEW METHOD FOR THE DETERMINATION OF COPPER.*

BY M. I. PELOUZE.

Gold and silver have hitherto been the only metals, the determination of which could be made by processes at once rapid and direct. The methods, which were also various, applied to the dosage of other metals are, no doubt, extremely good in the greater number of cases, but they are subject to divers inconveniences, the principal consisting particularly in the length of the operations, and the delicacy of the methods on which their appreciation is founded. The result of this state of things is a hiatus in the history of the most important alloys.

The transactions, of which metals are the object, require an analysis, the result of

* *Comptes Rendus*, Feb., 1846.

which can be obtained with great rapidity. In the case of commerce and art, it is almost an indispensable condition. The question of time overrules every other; an analysis that might be extremely useful in other respects, loses its value if the result is long in being obtained. What I assert as to the too long duration of an analytical operation, is not applicable to commerce, or operations in metallurgy alone; it is easily seen that the same observations are applicable to any establishment, whatever, in which we operate on large and frequently repeated meltings.

I will select examples of the truth of this assertion in the operations of mints and cannon foundries. The first of these examples will be the better chosen, because the remelting the sous, and the coining decimal money in copper or bronze, is now under consideration.

Medals in bronze ought, legally, to contain 950 per cent. of copper, and the law allows a deviation of 20-thousandths; they contain tin, and a very small quantity of zinc. We do not analyse them, but content ourselves by ascertaining that they contain copper and tin; they are then tried upon a touch-stone, taking as a means of comparison, alloys mathematically correct, according to the legal standard. The comparison of the marks left on the touch-stone, establishes the correctness of the metal; but this mode of operating is far from being exact, for a difference in the nature and proportion of the other metals, besides the copper, is sufficient to render all comparison with the normal touch impossible.

In the case of the alloy of ordnance, we can point out inconveniences of the same nature. As to copper coin and medals, it is, if not impossible, at least extremely difficult, to multiply analyses; the result of which may, nevertheless, be of the highest interest. The quantity of metal that runs off during the cooling of pieces of ordnance, and which, in the case of cannon of large calibre that are long in cooling, is considerable. This flow of metal has not been examined with all the care so important a subject demands.

The copper used in alloys is not always pure, and the result is much variation in the composition of the bronze, of which cannon is made.

The preceding observations will be sufficient to show how useful a process that would be, which should join great correctness to rapid execution. A process of this nature would enable us, among other things, to place the assay of medals, and copper or bronze money, on the same footing as that of gold and silver, and thus add one more difficulty to the production of impure coin. On the other hand, it would become much more easy to assay the alloys in the government cannon foundries even when in a state of fusion, and to add to the mass, at the instant, such quantities of copper or tin as should be necessary to produce the alloy, experience pointed out as the best in the manufacture of ordnance of various calibres.

Being placed, as assayer of coin, in a position where I could every day appreciate the extreme importance of the correctness and the rapidity of the mode of analysing alloys of silver, for which we are indebted to M. Gay-Lussac, aware also that all the advantages the arts have obtained from the normal liquors, so frequently introduced into factories by this celebrated chemist, I endeavoured to determine the copper by processes more or less resembling those of the humid method, persuaded that, after gold and silver, there is no metal the determination of which would be more important for it enters into the greater number of alloys, and those most frequently employed.

I have arrived at this result by several different methods, founded principally on the phenomena of precipitation, and instantaneous loss of colour.

Chemists are able to appreciate the skill with which M. Barreswil has been able to employ the solution of copper in tartaric acid, and potash, to resolve a very important and difficult question in organic analysis, that of the dosage of sugars. I at first hoped that by modifying cane sugar by means of acids, I could have produced normal liquors with which I could have endeavoured to calculate the proportions of copper contained in an alloy, by treating the latter successively with nitric acid, tartaric acid, and potash; but, after lengthened research, I was obliged to abandon the process; the approximations, sometimes very satisfactory, differed, however, often by 3, 4, and 5 hundredths of the real proportions of the copper, without my being able to ascertain the cause. Always, however, by substituting, for the sugar, modified by acids, a normal solution of perchloride of tin, I arrived at results much more exact.

The following was the second method:—I dissolved a given weight of copper, one gramme, for instance, in nitric acid. I added, in succession, to this liquid, solutions of tartaric acid and caustic potash. In this manner I obtained a solution of an intensely blue colour, into which I poured, while boiling, a weak solution of perchloride of tin. The perchloride of tin, eliminated by the alkali, absorbs half the oxygen of the oxide of copper, and precipitates the metal

in a state of metallic precipitate. The loss of colour by the liquor, pointed out the completion of the experiment.

Tin, zinc, lead, arsenic, or antimony, which might be present in alloys of copper, made no alteration in the preceding reaction; they formed oxides or acids, which remained in solution in the potash, in such a manner that if 50 cubic centimetres of the normal solution of tin were necessary to precipitate a gramme of pure copper, an equal number of divisions on the bottle will represent an equal weight of copper in these different alloys.

The other process, that on which I rest, is founded, as I have said, on the same principle; but the dissolution of the copper takes place in ammonia, a circumstance that renders the colour much deeper than tartaric acid and potash. To substitute alkaline monosulphurets for the perchloride of tin (particularly that of sodium, crystallised and colourless hydrosulphate of soda,) which we meet with in commerce.

The following is the mode of operating:—We dissolve 1 gramme of perfectly pure copper, in from 7 to 8 cubic centimetres of the nitric acid of commerce; we dilute the solution with a small quantity of water, and pour into it ammonia in excess (from 20 to 25 cubic centimetres). By this means we obtain an intensely blue solution.

On the other hand, we dissolve sulphuret of sodium in water. This solution may vary in strength, without any inconvenience. We place, for example, 110 grammes in 1 litre of distilled water; we introduce it into a graduated phial, divided into tenths of cubic centimetres, and we heat the ammoniacal liquor to the boiling point; we then add, by degrees, the sulphurous liquor. We will suppose that it requires 32 cubic centimetres to remove the colour from 1 gramme of copper, and this we have a normal liquor of a known strength.

We next take, dissolve in nitric acid or aqua regia a known weight: for instance, 1 gr. 100 of the alloy to be analysed; we super-saturate the solution with boiling ammonia, and pour into it the liquor containing sulphuret of sodium, until the colour is removed, taking care, from time to time, to add weak ammonia, to replace that lost by evaporation. The fading of the blue colour easily indicates to the operator whether the experiment is far from, or near to, its completion, and he must carefully add the last portion of the sulphuret, drop by drop.

When he judges that the operation is completed, he reads on the phial the number of divisions that have been required to remove the colour; if thirty-one have been needed, then there was one gramme of copper in 1 gr. 000 of alloy, if the tin employed 24·8, by dividing this number by 31, and the quotient by 1·100, we have 0·727, for the title of the alloy, &c.

This mode of operating is sufficient in the greater number of cases, the error it produces is merely five or six thousandths, but we obtain a much more correct result, by completing the removal of the colour from the blue liquid, with a very weak solution of sulphuret, with a liquid, for example, containing in every cubic centimetre, the quantity of sulphuret necessary to precipitate two milligrammes of copper. In this respect I have followed the instructions laid down by M. Gay-Lussac, for the analysis of alloys of silver, in the humid way, and I must acknowledge that I have borrowed much from my illustrious master.

It is necessary to ascertain that the presence of the metals we usually find mixed with copper, produce no variation in the calculation of the latter. On this point I have made numerous experiments, which have led me to the most satisfactory results.

I have added to a known weight of fine copper, various proportions of tin, zinc, cadmium, lead, antimony, iron, arsenic or bismuth, and I have constantly ascertained the quantity of copper to within two or three thousandths. I have requested a great many chemists to repeat these experiments, on different proportions of copper mixed with very different combinations of the preceding metals, the weight of which was unknown to them; and they have always decided on the proportion of copper to within a few thousandths.

Even students, with only a few months' practice in chemical manipulation, have made equally correct analyses. I mention this circumstance to show that the new process can be easily put in practice. I also mention it, because I consider this mode of proceeding with pure substances, whose proportions are unknown to the person who operates, is extremely instructive.

The experiments I have just spoken of,

I intend to repeat this experiment more in detail, to see whether it is applicable to cases in which copper is alloyed with cobalt or nickel.

* The ammoniacal liquor, from which we have precipitated the copper, remains only a short time colourless, it becomes blue by degrees, because the sulphuret of copper absorbs oxygen, and is converted into a sulphate.

sufficient to judge of the correctness of my process, but I have discovered a second method, showing that the metals previously mentioned, are not attacked by the sulphuret of sodium, so long as there remains the least trace of copper to be precipitated. In fact, when we place the sulphurets of zinc, cadmium, tin, lead, bismuth or antimony, in contact with a solution of ammoniacal nitrate of copper, they deprive it of colour, some when cold, others with the assistance of heat; and this evidently proves that these sulphurets cannot be produced and exist, unless it be perhaps for an instant, in the presence of the solution of copper; their formation after the removal of the colour, has no influence on the results of the analysis, because we calculate the conclusion of the latter by the removal of colour from the liquid, without regard to the precipitates that may be afterwards formed. If we wish to pay any attention to them, it can only be for the purpose of obtaining information as to the nature of the metals that accompany the copper. Thus if the alloy is formed of copper, tin, and zinc, we easily discover the presence of tin by the white precipitate that succeeds the black precipitate of sulphuret of copper, the lead or tin being precipitated immediately by the ammonia itself. In addition to this, I hope I shall succeed in ascertaining the quantity of the zinc itself by the amount of the solution of the sulphuret, it will be necessary to employ to precipitate this metal, reckoning from the moment the copper has lost its colour.

Cadmium also, like zinc, begins to precipitate itself more distinctly after the copper. Even at the instant you have observed the liquid lose its colour, if you continue the addition of sulphuret, you will see a beautiful yellow precipitate of sulphuret of cadmium formed.

I have mentioned a considerable number of metals, the presence of which does not prevent the execution of the new process, and they are luckily those which are most frequently met with in the impure copper of commerce, or in the alloys, or ores of copper. It is evident that cobalt and nickel produce oxides that are soluble in ammonia and colour it, thus preventing the application of the new process. As to silver, its presence is no obstacle to the use of this process; only, after having dissolved the alloy in nitric acid, it is necessary to precipitate the silver by hydrochloric acid, and wash the chloride, on the filter, the liquid, and the water you wash it with, are employed for the dosage of the copper. By ascertaining the silver in the former way, and the copper by the new process, we readily find the proportions of the two metals, to within one or three thousandths.

Tin, which we often meet with in alloys of copper, is found in the ammoniacal nitrate of copper, in the state of stannic acid. This acid remains for a long time suspended, and it sometimes happens that it contains a minute quantity of sulphuret of copper, which gives it a colour. In every case, it prevents the transparency of the liquids, and renders difficult to decide when the removal of colour is complete. I have discovered a certain means of obviating this inconvenience. I shall remark when operating on the alloy of copper, tin, and lead, that this last metal, often precipitated by ammonia in the state of nitric oxide, carried along with it the sulphuret, with which it is in part combined, and thus the liquid afterwards became clear, with great rapidity, and precipitated by this means, without which the last trace or three hundredths of copper would have been protracted with difficulty, and I add to all my essays of copper and tin, a certain quantity of solution of nitrate of lead, prepared beforehand. It is sufficient to shortly boil the liquids, to add one cubic centimetre of the solution, containing one decigramme of lead.

Another observation I have made rectifies an error propagated in all treatises on Chemistry. We believed that the precipitate obtained by pouring a soluble sulphuret into a hot solution of oxide of copper, was a bisulphuret, but it is a combination of bisulphuret, and an oxide of copper, and one sulphuret, formed of 5 equivalents of the sulphuret, and 1 equivalent of the oxide. I was induced to examine it, by observing that it required much more sulphuret of sodium at the ordinary temperature, than when the liquids were at a boiling heat, to precipitate the same weight of ammoniacal nitrate of copper, and that a solution of copper lost its colour, by boiling with the precipitated sulphuret over which it lay, a fact that was explained by the combination of the sulphuret with the oxide of copper.

Independently of the analysis I made of this new combination, that well washed bisulphuret of copper, boiled with sulphuric acid, gives off the oxide, forms the sulphate, and leaves in the water free and pure sulphuret of copper.

We have seen what use I have been able to make of the property presented by ammonia, of raising so intensely the blue colour of salts of copper; and we know that this reaction is one of the chief characteristics of copper; but I have found in the employment of ammonia a property much more important still, and without which it would, perhaps, have been impossible to establish

ON THE ACTION OF PERCHLORIDE OF GOLD UPON THE HYPOSULPHITE OF SODA.

When a solution of perchloride of iron is added to a solution of hyposulphite of soda, the iron is reduced to the state of protochloride, and the hyposulphurous acid is converted into a new acid, which has been called bisulphited hyposulphuric acid, and represented by the following formula:

$$2(NaO,SO_2) + Fe_2Cl_3 = 2(NaCl) + Fe_2Cl + 2(SO_2,SO_3)$$

The acid SO_2,SO_3 is equally formed in the reaction of salts of binoxide of copper upon the hyposulphites. The present investigation was undertaken with a view to ascertain whether the perchloride of gold acts upon the hyposulphite of soda like the perchloride of iron. Besides the scientific interest attached to this question, there is likewise one of a different kind; for it is known that the liquid at present employed to fix the Daguerreotypes is prepared by mixing aqueous solutions of perchloride of gold and hyposulphite of soda in certain proportions. The nature of this liquid is perfectly well known, and we have thought that an accurate examination of its composition and properties might furnish the means of remedying some of the inconveniences which occur in its employment.

To obtain this liquid, the use and preparation of which have been described by M. Fizeau, I grain of chloride of gold is dissolved in 500 grains of pure water, and in another vessel 9 grains of crystallized hyposulphite of soda in the same quantity of water. The solution of gold is then gradually poured into that of the hyposulphite, agitating the mixture. The whole then is the liquid at first becomes red, but soon colourless, when the operation is finished. The question to be ascertained was, whether this liquid contained only chloride of sodium and a double hyposulphite of soda and peroxide of gold, or whether the perchloride does

not rather exert in this case an oxidising action on the hyposulphite, yielding, among other products, the sulphated hyposulphate of soda, as in other analogous cases.

The liquid thus prepared is colourless, which leads to the supposition that it does not contain a persalt of gold. Admitting this supposition as proved, it is readily ascertained that the oxygen which the gold has parted with has not given rise to the production of sulphuric acid, for the precipitate which it yields with chloride of barium is soluble in hydrochloric acid. This leads us to conclude that a lower oxide of sulphur has been formed, for the liquid readily undergoes change, being decomposed, even when evaporated *in vacuo*. Thus prepared, it is too dilute for analysis; and in the impossibility of concentrating it, we have been compelled to let the two salts act on one another, dissolved in very small quantities of water. The liquid thus obtained yields a very abundant precipitate with alcohol of 0·951 spec. grav. The reaction is the same as with more dilute solutions, only the mixture should be made with greater precaution; it is especially necessary to wait after each addition until the liquid has become perfectly colourless, otherwise a brown body is formed, which it is very difficult to remove, and which results from the action of the perchlorides of gold on the products first formed.

EXAMINATION OF THE PRECIPITATE OBTAINED WITH ALCOHOL.

This precipitate is a mixture of several salts; it is almost entirely composed of a salt, the properties and composition of which we are about to describe, but it moreover contains variable quantities of all the products contained in the supernatant liquid. To purify it it must be repeatedly dissolved in a little water and precipitated with absolute alcohol. The salt which we examined had been precipitated five times in this way, as long as the quantity of gold which was estimated after each precipitation varied.

The salt thus purified is perfectly colourless, and crystallises in needles; it is insoluble in strong alcohol, and but sparingly in spirit, but excessively soluble in water. It has a sweet taste. Its aqueous solution possesses all the properties of M. Fizeau's liquid; and M. Lecoeur, who carefully compared the action of the two, gives the preference to the solution of our salt, on account of the richness of the tints which it imparts to the images.

This salt is the active constituent of M. Fizeau's liquid, freed from all foreign substances. When heated gently in a glass tube, it gives off water, then sulphur and sulphurous acid; it consequently contains water of crystallisation, which, however, cannot be expelled by a temperature of 212°. 1 gram of the salt well dried in the air, exposed for 2 hours to 248°, lost nothing in weight; at 302° to 320°, the salt became slightly yellowish, but without being perceptibly decomposed. At this temperature, 0·954, and even 0·970 of water was expelled; but this water was soon reabsorbed on exposing the salt to the air. The rapidity with which it reacquires its water of crystallisation renders its estimation difficult: the salt varies in its weight each instant, and in 24 hours it has completely regained its water. When heated strongly in a platinum crucible, it leaves a residue consisting of gold and sulphate of soda, without any trace of chloride. This property renders its analysis very easy.

When treated with nitric acid, the reaction is very lively, it disengages red vapours, and deposits metallic gold; the liquid contains a large quantity of sulphuric, but no hydrochloric acid. Sulphuretted hydrogen and the alkaline sulphurets produce a yellowish-brown precipitate in its solution.

The salt contains no chlorine, but gold, sulphur, and soda, the proportions of which will be seen from the following analyses:—

I. 1 gram of salt was ignited in a platinum crucible; the residue, on treatment with water, yielded 0·324 metallic gold, and 0·6805 sulphate of soda.

II. 1 gram of salt, treated with nitric acid, gave a precipitate of 0·3758 gold, and the separated liquid gave with chloride of barium 1·724 sulphate of baryta, representing 0·2485 sulphur.

These experiments, repeated several times on more than ten different samples, always gave the same results, leading to the following numbers:—

	Found.	Equivalents.	Calculated.
Gold	37·58	1	37·56
Sulphur	24·85	8	24·81
Soda	12·85	4	12·79

Supposing the sulphur to exist in the salt in the state of hyposulphuric acid, and the gold as a protoxide, and calculating the atomic weight by the loss, we obtain the following formula:—

$$AuO, S_2O_5 + 2(NaO, S_2O_5) + 4HO.$$

We shall now describe an experiment which shows more clearly the relations in which the gold and sulphur exist in the salt. We have already shown that the hyposulphites absorb iodine, giving rise to the new acid S_4O_5, and that for every equivalent of hyposulphite employed half an equivalent of iodine is absorbed.

When an alcoholic solution of iodine, in

added to the solution of our salt, the iodine is rapidly absorbed; and if care be taken to stop the moment the liquid begins to be coloured, the quantity of iodine consumed accurately represents the amount requisite to transform the whole of the sulphur contained in the salt, supposing it to exist in it in the form of hyposulphurous acid, into bisulphated hyposulphuric acid. Subsequent examination of the liquid proved moreover, that it contained bisulphated hyposulphate of soda.

I. 2 grms. of the salt absorbed 0·95 iodine from the alcoholic solution.

II. 1 grm. absorbed 0·485.

III. 5 grms. of iodine were dissolved in 200 cubic centimetres of alcohol, and 2 grms. of the salt required 38 divisions of Gay-Lussac's alkalimetric tube=38 cubic centimetres containing 0·96 iodine.

The mean of these three experiments answers to 48·2 iodine absorbed for 100 grms. of salt; that formula requires 47·7.

This salt consequently behaves towards iodine like an hyposulphite. The gold exists in it in the state of protoxide, for when an alcoholic solution of iodine is added to a concentrated solution of the salt no precipitate is formed; but if, after saturation with iodine, the liquid is diluted with much water, protiodide of gold is immediately deposited of a pure yellow colour; but this compound is soon converted under the influence of the alkaline iodide in the liquid, into metallic gold and periodide. The precipitation of the protiodide of gold without any free iodine proves that it results from the double decomposition of protoxide of gold and an alkaline iodide, a decomposition which in this case only occurs under the influence of water. The reaction of the iodine on the gold salt is represented by the following equation:—$I^2 + Au^2S^4O^6, 2(NaOS^2O^2) = AuI + 2NaI + 2(S^4O^5NaO)$. In all the preceding experiments we have considered the salt in question as a double hyposulphite of protoxide of gold and soda; all the above experiments agree with this hypothesis; there are, however, others which might lead to a different supposition. Sulphate of iron, chloride of tin and oxalic acid are not capable of indicating the presence of gold in this compound.

In fact, not only are the properties of this metal masked, but even some of the characters of the hyposulphurous acid. Thus nitric acid alone decomposes it in the cold: hydrochloric, dilute sulphuric, and the vegetable acids may be added to its solution, without producing any deposit of sulphur or disengagement of sulphurous acid. On the other hand, when chloride of barium is added to its solution, a compound is formed, which is sparingly soluble in water, but which alcohol throws down completely from the liquid as a gelatinous precipitate, a salt in which the equivalent of oxide of gold is retained, while those of the soda are replaced by baryta.

On treating this salt with an equivalent quantity of sulphuric acid, the baryta is completely separated as sulphate, and the corresponding double hyposulphite of protoxide of gold and water is obtained; this is a non-crystallizable, very acid compound, which is tolerably permanent at the ordinary temperature.

The solutions of the metals of the last 7 sections do not yield analogous compounds; they decompose the salt entirely.

EXAMINATION OF THE LIQUID ABOVE THE CRYSTALS.

The leys from which the preceding salt has been precipitated by alcohol, when sufficiently evaporated, yield crystals of chloride of sodium, sulphate of soda, and a deposit of sulphur; there is, moreover, a disengagement of sulphurous acid. These different products show that, independently of the gold salt and of the chloride of sodium, there exists in these liquids a bisulphated hyposulphate of soda, which it is impossible to isolate on account of its instability. To ascertain this, we determined the quantities of the salts taking part in the reaction, in order thus to establish directly the first term of the equation which ought to represent it.

We employed for this purpose a solution of gold, the strength of which was known, and added it to a known weight of hyposulphite of soda, agitating after each addition. The coloration produced by each fresh dose of perchloride of gold soon disappeared, and we stopped when the colour became permanent. We found, on calculating our results, that each equivalent of gold employed in the state of perchloride, required eight equivalents of hyposulphite of soda. To obtain accurate results, the mixture must be made slowly; otherwise it is difficult to attain the point of saturation accurately. But, notwithstanding the difficulties, we consider this method as demonstrative, as we twice obtained very good results.

Each grammes of gold requires 5 grms. hyposulphite of soda, which almost exactly corresponds to the quantities prescribed by M. Fizeau in his first paper, viz. 1 grm. chloride of gold and 3 grms. hyposulphite; these must remain in the liquid a small excess of hyposulphite. It is certain, however, that the action of the perchloride of gold on the hyposulphite of soda may be represented by the following equation:—$8(NaO\,S^2O^2) + AuCl^3 + 4(HO) = 2(NaO$

(AuCl) + MnO, SO3, 3(NaO, S2 O2), 4 HO,

lorid by substituting for double hyposulphate of soda but this is perfectly o destroy in fixing the Daguerreotypes, it is, indeed, probably injurious, from the exc - acids which it parts with, sulphuric under the - influence of heat, which may possibly con - tribute to the formation of those black spots that frequently cause the best proofs to be rejected; it is also probable that we must attribute to its presence in great part the - alteration which M. Fizeau's liquid, under - goes in the course of time; those who have - made frequent use of it know that it can - scarcely be kept for two months, this - places the amateur under the necessity of preparing it himself, which, although sim - ple and easy for those accustomed to chemi - cal experiments, it is by no means so for the uninitiated. To succeed, it is necessary to follow the instructions of M. Fizeau exactly, and especially to employ pure products, which it is not always easy to obtain in - commerce. We consider it, therefore, useful to substitute for M. Fizeau's liquid a solution of - pure salt; it would then suffice, to obtain a - suitable liquid, to dissolve 1½ grm. of this - salt in 1000 grms. water. Another advantage is, that this salt may be readily transported, in small volume, being equivalent to - chorinous mixture of the liquid.

In this treatise we have detailed the first - results obtained by acting with perchloride of gold on the hyposulphite of soda; on further action other products are generated. Among these we have already mentioned a - brown body, which is soluble in water, - insoluble in alcohol, and which appears to contain more gold than the double hyposulphite we have analysed. This compound - sometimes converted into sulphuret of - gold when too much of the chloride of gold is employed; and lastly, these two products, under the influence of a large excess of chloride, mutually destroy each other, and the liquid contains only sulphuric acid and metallic gold.

A SIMPLE AND ECONOMICAL MODE OF PREPARING HYPOCHLOROUS ACID.*

BY M. A. WILLIAMSON.

The use that can be made of hypochlorous acid in several medico-legal manipulations has induced us to publish the following process:—

We take a perfectly neutral solution of sul - phate of soda at the ordinary temperature, and saturate it with chlorine by means of a current of chlorine gas; the chlorine is absorbed in great quantity. The liquid remains colourless, that is to say, the substance absorbed is not contained in the solution in an analysed state; it is certain that the neutral sulphate of soda is decomposed. The liquid, after saturation, consists of a mixture of bisulphate of soda, chloride of sodium, and, in addition to these, free hypochlorous acid. When submitted to distillation, hypochlorous acid passes over from the commencement of the operation; the liquid that first passes over contains almost all the acid, and each successive portion holds less and less than the preceding.

This compound liquid possesses oxidising properties of such energy that they considerably exceed, at the ordinary temperature, those of nitric acid itself, and there is no doubt it might be applied in many cases, whether in laboratories, or in the arts and workshops.

This product can be prepared in a large quantity by the above process, for the same sulphate of soda will serve for a number of successive operations. For that purpose, it will be sufficient to evaporate the residue of the distillation, to heat it until all the chlorine is disengaged under the form of hydrochloric acid, which may be collected; in this state the residue is again converted into neutral sulphate of soda, which can be redissolved and treated with chlorine as before.

The solution of hypochlorous acid may be easily prepared of sufficient strength to present, for a given weight, a bleaching powder superior to that of the compound of lime commonly employed. It can be preserved for a considerable time even in a concentrated state, and with very trifling decomposition, particularly if it is protected from the action of light, and necessarily against that of heat.

* *Journal de Chim. Med.*, March, 1846.

EXAMINATION OF THE VOLATILE ACIDS IN VIBURNUM OPULUS.*

BY L. VON MONDO.

Chevreul found in the berries of Viburnum opulus phocenic acid, the identity of which with valerianic acid has been proved by Dumas. Krämer has submitted the bark of Viburnum opulus to examination, and considers the volatile acid obtained from it, as well as its salts, not to be identical with valerianic acid from their external properties.

* *Chem. Gazette* and *Ann. de Chim.*, &c.

The author was induced to repeat this investigation.

The bark of young trees of viburnum was peeled off in spring, carefully comminuted, and submitted to distillation with water to which some sulphuric acid had been added. Four pounds of bark yielded forty quarts of acid liquid. The distillate was saturated with carbonate of soda and evaporated, when an oil, having the odour of viburnum, volatilized. The concentrated liquid was again distilled with sulphuric acid to obtain the pure acid; it separated partly in oily drops on the surface of the distillate, and was partly dissolved in it. The drops of oil had the peculiar and strong odour of cheese, as well as the other properties of valerianic acid; the baryte and zinc salts crystallized from the hot solution in pearly laminæ, the silver salt in fine dendritic crystals. The entire distillate was saturated with ammonia and treated with nitrate of silver: it yielded a beautiful white light crystalline precipitate. This precipitate when boiled became black, probably from a small quantity of formic acid which had been formed, but beautifully white crystals separated from the filtered liquid. The first salt which crystallised was that of the volatile acid of Viburnum opulus, viz., valerianate of silver; the salt which separated from the mother-ley was pure acetate of silver.

The valerianate was readily separated from the acetate by recrystallisation, owing to its sparing solubility. On analysis it yielded—

Carbon	28·65	10	750·0	28·69
Hydrogen	4·33	9	112·2	4·30
Oxygen	11·55	3	300·0	11·47
Silver	55·47	1	1451·6	55·54

The acid discovered by Chevreul in the berries of Viburnum opulus consequently occurs, likewise, in the bark; and the acid considered as distinct by Kramer is identical with valerianic acid.

CHEMICAL EXAMINATION OF SEVERAL SPECIES OF MELOE.*

BY J. LAVINI AND M. SOBRERO.

The fluid which the several species of meloe excrete when touched has, as is well known, a similar effect to cantharides. It has long been the custom in Sardinia, to submit the living animals to pressure and to employ the expressed fluid when mixed with fat to form an epispastic ointment. The authors exhausted the coarse powder of several species which occur in Piedmont (M. violaceus, M. autumnalis, M. fucia, M. punctatus, M. variegatus, M. scabrosus, and M. majalis), first with boiling water and then with alcohol and ether. The aqueous solution, which possessed acrid properties, was evaporated to the consistence of a thin extract, and then treated with ether. The solution was colourless, and deposited on spontaneous evaporation white prismatic crystals, which were identical with cantharidine. When pure, they were insoluble in water, soluble in ether, especially when boiling, in alcohol, sulphuric acid, nitric acid, solution of potash, but insoluble in muriatic acid. They also dissolved in acetic acid, especially on the application of heat—a property which likewise belongs to cantharidine. They fuse, when heated on platinum foil to 410°, giving off white vapours; at a higher temperature they are decomposed and burn with a white flame, leaving a rapidly combustible residue. The analysis yielded 61·97 per cent. carbon, 6·50 hydrogen, and 32·53 oxygen—results which agree sufficiently with those of Regnaud, obtained in the analysis of cantharidine. The powder which had been exhausted with water, and from which the ethereal extract had been obtained, yielded a small quantity more cantharidine, a green oil easily soluble in alcohol and ether, which possessed acid properties, expelled carbonic acid from the alkaline carbonates, and formed soaps with them; moreover, a yellow oil, soluble in ether, but almost insoluble in alcohol; and finally, a white volatile substance, crystallising in warty masses and soluble in very dilute alcohol. When the substances which had been treated with ether was extracted with alcohol, it yielded nitre (traces of the substances soluble in ether already mentioned).

ON THE QUANTITATIVE ESTIMATION OF BROMINE IN MINERAL WATERS.

BY M. HEINE.

The usual quantitative test for bromine consists in mixing the solution supposed to contain the bromides with ether, then carefully adding chlorine water and leaving the fluid at rest; the ether collects on the surface. It is colourless when no bromine is present, faintly yellow when there is but a small quantity, slightly or strongly brown when in greater quantity. To make use of this test in quantitative investigations, several precautions must be taken. In the first place, it had to be ascertained whether the

* *Journ. de Pharm. et de Chimie*, vii. p. 467.

* *Journ. für Prakt. Chem.*, xxxvi. p. 181, and *Chem. Gazette*.

mother-leys, which are sometimes of a yellow colour, would impart this colour to the ether; experiments proved this not to be the case. On adding chlorine water to the leys, they were more or less decolourized, a proof that the yellow colour was owing to organic substances. It is further known that ether assumes a faint yellow tint when it is shaken with chlorine water; it became necessary to know whether a small quantity of chlorine water is capable of producing this colouration, or only large quantities. A considerable quantity of chlorine water was employed before its influence on the colour of the ether became perceptible. In order to ascertain with probability the quantity of bromine, so much chlorine water had to be employed that all the bromine was set free and taken up by the ether. It was therefore requisite to determine this quantity by the addition of more or less chlorine water to liquids containing the same amount of bromine, and by comparing the tints of the ether. The volatility of the ether and of the bromine had also to be considered, and the glasses had to be made so that they could be closed tight and very quickly, and at the same time be almost entirely filled. And lastly, it was requisite to use equal quantities of ether, &c., for all the experiments, and equally coloured, or rather colourless glasses of the same size, that the layer of ether might be of the same height and breadth.

In such cases as the above, in which the amount of bromine is by no means considerable, the method proposed for ascertaining its amount by means of a scale of colours appears to me more certain than the analytical determination from the mixture of chloride and bromide of silver, according to Rose. The numbers obtained for the bromine should, properly, be substracted from the amounts of chlorine, but they are not sufficiently large to render a re-calculation of the results of the analysis of the leys necessary.

Quite as accurately, if not more so, may iodine be estimated in liquids by the well-known method with solution of starch and nitric acid. A large amount of chlorine (which is the case in the brines and leys from salt-works) is, it is true, a hindrance; I have, however, convinced myself, by the addition of $\frac{1}{8000}$ iodide of potassium, that the reaction with starch and sulphuric acid is still perceptible. I only obtained distinct evidence of iodine in the mother-leys from the salt-works of Halle; in all the others none, or so very slight, that the presence of iodine cannot be asserted positively.

* It is necessary to use the strongest possible chlorine water, recently prepared.

OBSERVATIONS ON THE EXISTENCE OF A TERNARY SUBSTANCE IDENTICAL WITH CELLULOSE IN ALL THE MEMBERS OF A CLASS OF INVERTEBRATED ANIMALS; THE TUNICATA.*

BY MESSRS. C. LŒWIG AND A. KŒLLIKER.

The existence of a ternary substance resembling cellulose, having been pointed out last year by M. Schmidt in the integument of the Phallusia mamillaris, and that Fremy and Valenciennes, &c., we undertook a series of chemical and microscopical experiments for the purpose of ascertaining, in a positive manner, whether there really existed in the animal kingdom a substance without nitrogen, and analogous to cellulose ($C^{12}H^{10}O^{10}$), and, in the affirmative, a substance of this nature being discovered, to ascertain the elementary structure of the parts formed by it.

1. In all the animals of the class Tunicata that we had at our disposition, namely

a. Phallusia mamillaris
b. Phallusia intestinalis
c. Phallusia monachus
Cynthia papillata
Clavellina lepadiformis
Dicynia violacea
Botryllus polycyclus
Pyrosoma giganteum
Salpa maxima,

a great portion of the body is composed of a substance perfectly insoluble in a boiling concentrated solution of potash. This substance forms, both in the simple and aggregated ascidiæ, the outward covering of cartilage (clavellina, phallusia) or skin (cynthia); among the compound ascidiæ, the glutinous mass in which the groups of individuals are lodged; and in the genus salpa all that more or less solid external envelope that which the muscles, viscera, nerves, &c., are contained. It results from this fact, that if one of these animals is placed in a solution of potash, it retains, perfectly, its external form and contour; even when all the muscles, nerves, &c., are dissolved; so that the genera salpa, pyrosoma, botryllus, and phallusia exhibit all their rugosities, embossings, and angles, and preserve outwardly, their original appearance, even after digesting in the alkali for more than five days. Only, it is to be remarked, that in the case of the genus cynthia, the substance in question, having been previously deprived of its numerous calcareous deposits, is more flexible, and of a light colour; while in the case of the other tunicatæ we have mentioned, it acquires an almost perfect trans-

* *Comptes Rendus*, Jan. 5, 1847.

perency on account of certain parts being extracted by the alkaline solution.

2. This substance, insoluble in an alkali, is entirely without nitrogen, as we convinced ourselves by heating it in a tube after it had been dried, along with a mixture of lime and soda (phallusin, cynthia), or with hydrate of potash (phallusia, cynthia, salpa, clavellina, diazona, botrylus, pyrosoma). We may remark, for the sake of those who wish to verify this fact, that to succeed in this experiment, it is necessary to cut the envelopes in question into very small pieces before they are placed in the alkaline solutions; if this be not done, certain portions containing nitrogen, which are intermingled with the substance without nitrogen, will not be extracted, and this will infallibly lead the observer into error. Two elementary analyses undertaken; the one with 0gr.391 of the external envelope of the Phallusia mamillaris, prepared, as I have said, after the calcareous particles had been removed by means of muriatic acid, and dried, and the other with 0gr.189 of that of the Cynthia papillata, gave us the following figures:—

1. 100 parts of the ternary substance contained in the envelope of the Phallusia consisted of—

C	43·40
H	5·68
O	51·32

2. 100 parts of the ternary substance of the envelope of the Cynthia papillata consisted of—

C	43·20
H	6·16
O	50·64

As these figures exactly correspond with those discovered for cellulose, which is, in the same manner, insoluble in an alkaline solution, we do not hesitate to assert, that in the case of the tunicata, a great portion of the body is composed of a substance containing no nitrogen, and identical with the cellulose of plants.

As far as it regards other lower animals, we have found in one instance, one alone excepted, the least trace of a substance resembling cellulose; even the gelatinous, horny, cartilaginous substances, and ligneous parts of the polypi, medusæ, and certain other molluscous animals have exhibited nothing similar; this was proved by the rapid dissolution (in from five to twenty-four hours) they almost all of them underwent in a solution of potash; and by the ammoniacal vapours they exhaled, without exception, when burnt along with lumps of potash.

ON THE NEW METAL RUTHENIUM.

To the Editor of the Chemist.

Sir,—On the perusal of M. Claus' valuable researches on the new metal ruthenium, which appeared in the January number of the *Chemist*, I was struck by its peculiar behaviour with several reagents, and led to infer that it was the result of an imperfect separation of the metal, or, that another new metal gave rise to these peculiarities.

Perchloride of ruthenium, on being treated with sulphuretted hydrogen, gives a black sulphuret precipitate, and the solution assumes an *azure blue* colour. If the perchloride of ruthenium is treated with zinc foil, the solution assumes after a short time, a *blue* colour, which it afterwards loses, and metallic ruthenium is precipitated; but the reduction is incomplete: the cyanuret of mercury produces a blackish blue precipitate, and the solution assumes a *blue* colour. M. Claus does not account in any way for this *azure blue* colour, which he so distinctly remarks; that it does not result from a peculiar degree of oxidation, we may fairly assume from want of a similar example, but that it results from another new metal, we are fairly warranted in assuming, as we are well acquainted with similar instances.

I am, Sir,

Yours obediently,

JOHN THOMPSON.

sufficient to judge of the correctness of my process, but I have discovered a second method, showing that the metals previously mentioned, are not attacked by the sulphuret of lead, as long as there remains the least trace of copper to be precipitated. In fact, when we place the sulphurets of zinc, cadmium, tin, lead, bismuth or antimony, in contact with a solution of ammoniacal nitrate of copper, they deprive it of colour, some when cold, others with the assistance of heat; and this evidently proves that these sulphurets cannot be produced, and exist, unless it be perhaps for an instant, in the presence of the solution of copper; their formation after the removal of the colour, has no influence on the results of the analysis, because we calculate the conclusion of the latter by the removal of colour from the liquid, without regard to the precipitates that may be afterwards formed. If we wish to pay any attention to them, it can only be for the purpose of obtaining information as to the nature of the metals that accompany the copper. Thus if the alloy is formed of copper, tin, and zinc, we easily discover the presence of tin, by the white precipitate that succeeds the black precipitate of sulphuret of copper, the lead or tin being precipitated immediately by the ammonia itself. In addition to this, I hope I shall succeed in ascertaining the quantity of the zinc itself by the amount of the solution of the sulphuret, it will be necessary to employ to precipitate this metal, reckoning from the moment the copper has lost its colour.

Cadmium also, like zinc, begins to precipitate itself a very distinctly after the copper. Even at the instant you have observed the liquid lose its colour, if you continue the addition of sulphuret, you will see a beautiful yellow precipitate of sulphuret of cadmium formed.

I have mentioned a considerable number of metals, the presence of which does not prevent the execution of the new process, and they are luckily those which are most frequently met with in the impure copper of commerce, or in the alloys, or ores of copper. It is evident that cobalt and nickel produce oxides that are soluble in ammonia and colour it, thus preventing the application of the new process. As to silver, its presence is no obstacle to the use of this process; only, after having dissolved the alloy in nitric acid, it is necessary to precipitate the silver by hydrochloric acid, and wash the chloride on the filter, the liquid and the water you wash it with, are employed for the dosage of the copper. By ascertaining the silver in the humid way, and the copper by the new process, we readily find the proportions of the two metals, to a thousandth part more or less.

Tin, which we often meet with in alloys of copper, is found in the ammoniacal nitrate of copper, in the state of stannic acid. This acid remains for a long time suspended, and it sometimes happens that it contains a minute quantity of sulphuret of copper, which gives it a colour. In every case, it prevents the transparency of the liquid, and the difficulty to decide when the removal of colour is complete. I have discovered a certain means of obviating this inconvenience. A fact observed when operating on the alloy of copper, tin, and lead, that the last metal, when precipitated by ammonia in the state of tin oxide, carried along with it the sulphuret with which it was thought combined, and thus the liquid afterwards became clear, without any regularity, and profited by this remark, without which the last two or three hundredths of copper would have been objected with difficulty; and I wish to all my essays of copper and tin, or antimony, a solution of nitrate of lead, prepared beforehand. It is sufficient to clarify all the liquids, to add one cubic centimetre of the solution containing one decigramme of lead.

Another observation I have made rectifies an error propagated in all treatises on Chemistry. We believed that the precipitate obtained by pouring a soluble sulphuret into a hot solution of a salt of copper, was a bisulphuret, but it is a combination of the sulphuret, and an oxide or copper, an oxysulphuret, formed of 3 equivalents of the sulphuret, and 1 equivalent of the oxide. I was induced to examine it, by observing that it required much more sulphuret of sodium at the ordinary temperature, than when the liquid was at a boiling heat, to precipitate the same weight of ammoniacal nitrate of copper, and that a solution of copper lost its colour, by boiling with the precipitated sulphuret over which it lay, a fact that was explained by the combination of the sulphuret with the oxide of copper.

Independently of the analysis I made of this new combination, that well washed bisulphuret of copper, boiled with sulphuret carries off the oxide from the salt, and leaves in the water free and pure sulphuric acid alone.

We have seen what use I have been able to make of the property presented by ammonia, of raising so intensely the blue colour of salts of copper; and we know that this reaction is one of the chief characteristics of copper; but I have found in the employment of ammonia a property much more important still, and without which it would perhaps, have been impossible to determine

the copper by means of the liquid in the precipitated with the alkaline sulphuret, etc., then it presents the salts of copper being precipitated by the hyposulphites. We know that these latter salts are almost always met with in alkaline sulphurets; and that they are also possessed of the constant of association with the description of sulphurets. Consequently they exist in them, or are formed in the solution under known proportions, and are, besides this, liable to change every instant, and we know that they decompose the salts of copper, either mutual or acid, producing a precipitate of sulphuret of copper; but no chemical opposes itself to this decomposition; it not only does it permit the hyposulphites to decomposing these solutions, but it even protects the same property with respect to the sulphites and sulphyposulphites. Happily when in small proportions, it equally hinders the precipitation of the same metal by the carbonates of alkaline oxides, these circumstances are so much the more important, from all these bodies existing together, as it being possible that they may frequently do so, in soluble sulphurets.

The strength of a solution of sulphuret of sodium is impaired by contact with the air; but this change is extremely slow, and it is unnecessary to change the liquid, as long as any remains in the phial in which it was placed. The only precaution to be employed, and this is applicable to all normal solutions, consists in determining the present strength of the sulphuret by means of a known weight of fine copper, every time you make an assay of the copper. We can easily meet in commerce with plates of copper of this description, obtained by the electrotype process.

In a memoir which I shall soon have the honour of laying before the Academy, I intend to explain more fully the new method of dosing the copper, which I have just described, I will point out the numerous applications of which it appears to me to be susceptible, and I will add a table of the composition of a large number of copper coins and medals, struck in France. I am already enabled to affirm that this method applied to the analysis of copper ore, yields the most correct results. The execution also is so simple, and expeditious, that I have no doubt the copper will be determined at the very spot where it is raised. If I do not deceive myself, this new mode of assaying copper will render real services to the administration of the mint, the government foundries, and in factories.

I will add one word more, in conclusion. Two young chemists, who have worked in my laboratory, have undertaken to determine, each by means of mutual liquids, their labours are already sufficiently advanced to give hope of satisfactory solution.

I have said that zinc would, without doubt, be determined by sulphuret of sodium; if these hopes are realised, we must add to gold, silver, and now, copper, the exact and rapid determination of zinc, dead, and in a partial manner

ON THE ACTION OF PERCHLORIDE OF GOLD UPON THE HYPOSULPHITE OF SODA.*

By J. ROBIQUET and GELIS.

When a solution of perchloride of iron is added to one of hyposulphite of soda, this iron is reduced to the state of protochloride, and the hyposulphurous acid is converted into a new acid, which some have called bisulphited hyposulphuric acid, and represented by the following formula S^4O^5. The said S^4O^5 is equally formed in the reaction of salts of bin-oxide of copper upon the hyposulphites. The present investigation was undertaken with a view to ascertain whether the perchloride of gold acts upon the hyposulphite of soda like the perchloride of iron. Besides the scientific interest attached to this question, there is likewise one of a different kind; for it is known that the liquid at present employed to fix the Daguerreotypes is prepared by mixing aqueous solutions of perchloride of gold and hyposulphite of soda in certain proportions. The nature of this liquid is perfectly unknown, and we have thought that an accurate examination of its composition and properties would furnish the means of remedying some of the inconveniences which occur in its employment.

To obtain this liquid, the use and preparation of which have been described by M. Fizeau, I grm. of chloride of gold is dissolved in 500 grms. of pure water, and in another vessel 3 grms. of crystallised hyposulphite of soda in the same quantity of water. The solution of gold is then gradually poured into that of the hyposulphite, agitating the mixture the whole time; the liquid at first becomes red, but soon colourless, when the operation is finished. The question to be ascertained was, whether this liquid contained only chloride of sodium and a double hyposulphite of soda and peroxide of gold, or whether the perchloride does

* *Ann. de Chim. et de Phys.*, and *Chem. Gazette*.

ver, rather exert in this case an oxidising action on the hyposulphite, yielding, among other products, bisulphated hyposulphate of soda, as in other analogous cases.

The liquid thus prepared is colourless, which leads to the supposition that it does not contain a peroxide of gold. Admitting this supposition as proved, it is readily ascertained that the oxygen which the gold has parted with has not given rise to the production of sulphuric acid, for the precipitate which it yields with chloride of barium is soluble in hydrochloric acid. This leads us to conclude that a lower oxide of sulphur has been formed, for the liquid readily undergoes change, being decomposed, even when evaporated *in vacuo*. Thus prepared, it is too dilute for analysis; and in the impossibility of concentrating it, we have been compelled to let the two salts act on one another, dissolved in very small quantities of water. The liquid thus obtained yields a very abundant precipitate with alcohol of 0·951 spec. grav. The reaction is the same as with more dilute solutions, only the mixture should be made with greater precaution; it is especially necessary to wait after each addition until the liquid has become perfectly colourless, otherwise a brown body is formed, which it is very difficult to remove, and which results from the action of the perchlorides of gold on the products first formed.

EXAMINATION OF THE PRECIPITATE OBTAINED WITH ALCOHOL.

This precipitate is a mixture of several salts; it is almost entirely composed of a salt, the properties and composition of which we are about to describe, but it moreover contains variable quantities of all the products contained in the supernatant liquid. To purify it it must be repeatedly dissolved in a little water and precipitated with absolute alcohol. The salt which we examined had been precipitated five times in this way, as long as the quantity of gold which was estimated after each precipitation varied.

The salt thus purified is perfectly colourless, and crystallises in needles; it is insoluble in strong alcohol, and but sparingly in spirit, but excessively soluble in water. It has a sweet taste. Its aqueous solution possesses all the properties of M. Fizeau's liquid; and M. Lepeboer, who carefully compared the action of the two, gives the preference to the solution of our salt, on account of the richness of the tints which it imparts to the images.

This salt is the active constituent of M. Fizeau's liquid freed from all foreign substances. When heated gently in a glass tube it gives off water, then sulphur and sulphurous acid; it consequently contains water of crystallisation, which, however, cannot be expelled by a temperature of 212°. A gram of the salt, well dried in the air, exposed for 2 hours to 212°, lost nothing in weight; at 302° to 320° the salt became slightly yellowish, but without being perceptibly decomposed. At this temperature, 0·964, and even 0·970 of water was expelled; but this was very soon reabsorbed on exposing the salt to the air. The rapidity with which it reacquires its water of crystallisation renders its estimation difficult: the salt varies in its weight each instant, and in 24 hours it has completely regained its water. When heated strongly in a platinum crucible, it leaves a residue consisting of gold and sulphate of soda, without any trace of chloride. This property renders its analysis very easy.

When treated with nitric acid, the reaction is very lively, it disengages red vapours, and deposits metallic gold; the liquid contains a large quantity of sulphuric, but no hydrochloric acid. Sulphuretted hydrogen and the alkaline sulphurets produce a yellowish-brown precipitate in its solution.

The salt contains no chlorine, but gold, sulphur, and soda, the proportions of which will be seen from the following analyses:—

I. 1 gram of salt was ignited in a platinum crucible; the residue, on treatment with water, yielded 0·324 metallic gold, and 0·402 sulphate of soda.

II. 1 gram of salt, treated with nitric acid, gave a precipitate of 0·3278 gold, and the separated liquid gave with chloride of barium 1·724 sulphate of baryta, representing 0·2488 sulphur.

These experiments, repeated several times on more than ten different samples, always gave the same results, leading to the following numbers:—

	Found.	Equivalents.	Calculated.
Gold	32·45	1	32·58
Sulphur	24·88	1·8	24·81
Soda	11·85	2	11·72

Supposing the sulphur to exist in the salt in the state of hyposulphurous acid, and the gold as a protoxide, and calculating the water by the loss, we obtain the following formula:—

$$AuO, S^2O^2 + 2(NaO\ S^2O^2) + 4HO.$$

We shall now describe an experiment which shows more clearly the relations in which the gold and sulphur exist in the salt. We have already shown that the hyposulphites absorb iodine, giving rise to the new acid S^4O^5, and that for every equivalent of hyposulphite employed half an equivalent of iodine is absorbed.

When an alcoholic solution of iodine, in

added to the solution of our salt the iodine is rapidly absorbed; and if care be taken to stop the moment the liquid begins to be coloured, the quantity of iodine consumed accurately represents the amount requisite to transform the whole of the sulphur contained in the salt, supposing it to exist in it in the form of hyposulphurous acid, into disulphated hyposulphuric acid. Subsequent examination of the liquid proved moreover, that it contained disulphated hyposulphate of soda.

I. 2 grms. of the salt absorbed 0·95 iodine from the alcoholic solution.

II. 1 grm. absorbed 0·485.

III. 5 grms. of iodine were dissolved in 200 cubic centimetres of alcohol, and 2 grms. of the salt required 78 divisions of Gay-Lussac's alkalimetric tube, i.e. 39 cubic centimetres containing 0·98 iodine.

The mean of these three experiments answers to 48·2 iodine absorbed for 100 grms. of salt; the formula requires 47·7.

This salt consequently behaves towards iodine like an hyposulphite. The gold exists in it in the state of protoxide, for when an alcoholic solution of iodine is added to a concentrated solution of the salt no precipitate is formed; but if, after saturation with the iodine, the liquid is diluted with much water, protiodide of gold is immediately deposited of a pure yellow colour; but this compound is soon converted under the influence of the alkaline iodide in the liquid, into metallic gold and periodide. The precipitation of the protiodide of gold without any free iodine proves that it results from the double decomposition of protoxide of gold and an alkaline iodide, a decomposition which in this case only occurs under the influence of water. The reaction of the iodine on the gold salt is represented by the following equation:—$I^8 + Au^2O^2S^4O^8Na^2, 2(NaOS^2O^2) = Au^2I^2 + NaI + 2(S^4O^5NaO)$. In all the preceding experiments we have considered the salt in question as a double hyposulphite of protoxide of gold and soda; all the above experiments agree with this hypothesis; there are, however, others which might lead to a different supposition. Sulphate of iron, chloride of tin and oxalic acid are not capable of indicating the presence of gold in this compound.

In fact, not only are the properties of this metal masked, but even some of the characters of the hyposulphurous acid. Thus nitric acid alone decomposes it in the cold: hydrochloric, dilute sulphuric, and the vegetable acids may be added to its solution without producing any deposit of sulphur or disengagement of sulphurous acid. On the other hand, when chloride of barium is added to its solution, a compound is formed, which is sparingly soluble in water, but which dissolves then throws down completely from the liquid as a gelatinous precipitate a salt in which the equivalent of oxide of gold is retained, while those of the soda are replaced by baryta.

On treating this salt with an equivalent quantity of sulphuric acid, the baryta is completely separated as sulphate, and the corresponding double hyposulphite of protoxide of gold and water is obtained; this is a non-crystallisable, very acid compound, which is tolerably permanent at the ordinary temperature.

The solutions of the metals of the last sections do not yield analogous compounds; they decompose the salt entirely.

EXAMINATION OF THE LIQUID ABOVE THE CRYSTALS.

The leys from which the preceding salt has been precipitated by alcohol, when sufficiently evaporated, yield crystals of chloride of sodium, sulphate of soda, and a deposit of sulphur; there is, moreover, a disengagement of sulphurous acid. These different products show that, independently of the gold salt and of the chloride of sodium, there exists in these liquids a bisulphated hyposulphate of soda, which it is impossible to isolate on account of its instability. To ascertain this, we determined the quantities of the salts, taking part in the reaction, in order thus to establish directly the first term of the equation which ought to represent it. We employed for this purpose a solution of gold, the strength of which was known, and added it to a known weight of hyposulphite of soda, agitating after each addition. The coloration produced by each fresh dose of perchloride of gold soon disappeared, and we stopped when the colour became permanent. We found, on calculating our results, that each equivalent of gold employed in the state of perchloride, required eight equivalents of hyposulphite of soda. To obtain accurate results, the mixture must be made slowly; otherwise is is difficult to attain the point of saturation accurately. But, notwithstanding the difficulties, we consider this method as demonstrative, as we twice obtained very good results.

Each grammes of gold requires 5 grms. hyposulphite of soda, which almost exactly corresponds to the quantities prescribed by M. Fizeau in his first paper, viz. 1 grm. chloride of gold and 3 grms. hyposulphite; there must remain in the liquid a small excess of hyposulphite. It is certain, however, that the action of the perchloride of gold on the hyposulphite of soda may be represented by the following equation:—$8(NaO\,S^2O^2) + Au^2Cl^3 + 4(HO) = 2(NaO$

calculate the changes that may take place in the arrangement of the atomic elements, in living bodies, he observed:—

Let us now resort to a few suppositions—

1. Let us suppose, that the cryptogamic stems may be endowed with the property of resisting the action of a certain degree of heat and cold, without losing their reproductive powers.

2. Let us suppose they can enter every living body by means of the water, the air, or the different aliments on which it is supported.

3. Let us suppose that these superior living bodies, vegetables, and animals, may possess a vital pre-eminence over that of these atoms, and that the latter can enter, leave, or fix themselves in every part of these organizations, without having their former nature modified in the smallest degree.

4. Let us suppose, next, that the organised bodies, vegetables, or animals, should be struck with death and decomposed, and that the germs they may contain, will, as it were, recovering their liberty of action, and the conditions their nature requires, develop themselves, and we shall have a natural explanation of the great extent of the mouldiness observed on the stalk and other diseased or dead parts of the tubers, and from which all those portions that are still living and healthy are free.

5. Let us suppose, again, that every living body, vegetable, or animal, has the power of absorbing and retaining certain kinds of these minute bodies, and resisting the introduction of others, or rather rejecting them after they have been absorbed, or even, if necessary, decomposing them; and we shall have an explanation of the special cryptogamous plants attributed to such or such a body, such and such fluids, even acids or saline liquids, which have been observed and described by numerous microscopic observers; with this condition, we accept of the *Fusisporium solani* and all the musicideus and other fungi, they feel inclined to name after the plants on which they are usually met with.

6. Suppose, finally, that organised living bodies should be impermeable to these reproductive atoms, and that those we meet with on them, when diseased or dead, are derived from the external elements, such as the water and air, which penetrate them physically, and not physiologically, and we shall have completed the circle of the principal probabilities, and we shall have restored, as it were, this obscure part of the subject, still enveloped in mystery, into the philosophical and rational path of science.

But, suppositions although, in our minds, always useful, in so far as they open the way to discovery, do not, in themselves, possess any scientific value; let us then abandon them. To conclude with facts relating to our subject, let us prove that the diseased stem and tubers of the potato, like all other organic bodies in a state of decomposition, be the cause what it may, give birth to an abundance of vegetable and animal production, whether microscopic or otherwise; as insects, which there accomplish all their metamorphoses, until they attain the perfect state, and that cubic crystals of oxalate of lime are met with in the healthy tubers in as large a quantity as in those affected with the disease.

Let us also prove that we have not found in the tubers a single specimen of the mycoderm of the leaves and stems above ground, and that, on that account, one cannot have been produced by the other.

Let us call to mind, that the learned naturalists who have studied the disease of the potato, and who have generally attributed it to microscopic fungi, have found, in succession—M. de Martius, a new species, which he has called Fusisporium solani; Mr. Chr. Morrell, the Botrytis spiphyla; Dr. Montagne (who is certainly a high authority particularly in this part of the science), the Botrytis infestans; finally, the associates M. Payen, and ourselves, numerous species distinct from these, which, in our minds, is as much as to say that all the microscopic fungi, whether new or old species, have this year coalesced against the potato.

Even if only a single species of fungus should have been met with in the diseased potatoes of all countries, even if a single species should have preceded and predominated over every other, we still would not acknowledge that it had been the cause of the first injury to the tubers, so strongly are we convinced that the perfect, and healthy living tissues of vascular vegetables have the power of repelling the attacks of the smallest lived productions.

Judge now, therefore, gentlemen, if the presence of all the fungi we have noticed, if we could have thought of attributing to them such general and disastrous ravages.

From these considerations, all superficial as they are, the Academy will conceive that we must naturally reject those hypothetical opinions, the supposition of which would induce us to believe that the disease of the potato had originated in its general cause, proceeding either from vegetable, animal, or mineral productions, and that even if cold, moisture, and perhaps electricity are not the first cause of the disease, we must seek them elsewhere than in parasitic productions.

IMPROVEMENTS IN THE MANUFACTURE OF BLUE, TO BE USED AS A SUBSTITUTE FOR STONE-BLUE.*

BY JOHN LEIFCHILD.

This invention consists in combining certain descriptions of blue colour, known as Chinese blue and Turnbull's blue, with oxalic acid, so as to render them suitably soluble in water, in order that the combined matters may be used instead of stone-blue, for colouring linen after washing.

The mode of operating is as follows:—4 parts by weight of Chinese blue, 1 of Turnbull's blue, and one of oxalic acid are well-mixed together, and boiling water is gradually added until the whole is dissolved; and then to this combination an addition is made of 1 part by measure of the liquid called sulphate of indigo, which is produced by mixing 1 part of indigo with 4 parts of concentrated sulphuric acid, and afterwards neutralising the excess of acid by means of carbonate of ammonia. The combined liquid, when required for use, is reduced in intensity of colour to the extent desired, by the addition of water; it is then ready to be employed for blueing linen after washing, as hitherto practised when stone-blue in water has been used.

DR. MUSPRATT ON THE CHEMISTRY OF VEGETATION, &c.†

A series of communications containing analyses of the ashes of plants and manures, and other useful information connected with the tillage of the earth, have been so long required, and are so essentially of service at the present time when artificial fertilisers are coming into vogue, that at the suggestion of numerous friends I undertook to amass all the information in my power and now place it before the agriculturists, with the view of affording them an insight into the economy of the vegetable world. There can be little doubt that in a few years all the recrements of the farm-yard will be carefully collected and applied to the fields, and, as science advances, the results of the field produce will be conducted to with as much surety as those of the laboratory, and will ultimately point into the true path for the farmer to take in order to keep his land in a fertile condition.

It must be evident to all reflecting minds that there is a variety of substances at present discarded, which sooner or later, will constitute races of vegetables, and contribute to the sustenance of thousands of beings; for we know that all bodies are only lost to us for a time: even organic matter, which during its degradation is resolved into carbonic acid, water, and ammonia, finally re-enters the vegetable organism in the persistent form, destined to pass again through the same ceaseless cycle of vicissitudes and metamorphoses. I shall first commence with the tuberous plants, appending a numerical statement of the constitution, and composition of the inorganic ingredients of turnips and potatoes, which are cultivated to such a great extent in Europe and elsewhere:—

CONSTITUTION WHEN TAKEN FROM THE FIELD.

		Turnips.		Potatoes.
1.	Water	38·314	—	14·625
	Organic matter	5·374	—	4·651
	Inorganic salt	·322	—	·135
		44·000 lbs		19·500 lbs

CENTESIMALLY REPRESENTED:—

		Turnips.		Potatoes.
2.	Water	87·057	—	75·000
	Organic matter	12·210	—	24·000
	Inorganic salt	·733	—	1·000
		100·000		100·000

PER CENTIC. COMPOSITION OF THE INORGANIC INGREDIENTS OF TURNIPS AND POTATOES.

TURNIPS.

	Tubers.		Leaves.
Silica	6·15	—	7·07
Phosphoric acid	5·80	—	5·42
Sulphuric acid	12·70	—	13·34
Chlorine	13·79	—	4·80
Lime	1·91	—	34·21
Magnesia	4·02	—	3·24
Iron	·50	—	·03
Potash	37·69	—	17·69
Soda	16·62	—	12·26
Loss	·82	—	·50
	100·00		100·00

POTATOES.

	Tubers.		Leaves.
Silica	1·01	—	16·08
Phosphoric acid	4·82	—	6·30
Sulphuric acid	6·52	—	1·33
Chlorine	1·39	—	1·61
Lime	3·99	—	42·33
Magnesia	3·91	—	5·49
Iron	·39	—	·85
Potash	48·50	—	26·49
Soda	28·19	—	·27
Loss	·68	—	·04
	100·00		100·00

By referring to table 1, it will be seen that a crop of turnips removes from the soil 322

* *Newton's Journal.*

† Communicated to the *Farmer's Journal*.

pounds of inorganic salt, which, by calculating from table 3, contain about 180 pounds of alkalies. Now, it being a well-established fact that some of the best samples of guano only contain 4 per cent. of potash and soda, it necessarily follows that a farmer must administer upon well-drained land two tons of this deposit in order to restore the alkalies, abstracted either by a crop of turnips or potatoes.

The quantity of guano generally applied to the acre is 5 cwt, which contain 20 pounds of the fixed alkalies; consequently, were the farmer to grow turnips or potatoes for three or four years successively, upon the same land, manuring each crop with guano, he would have removed seven times the amount of alkalies he had returned to his soil, and by continuing in such a course, the land would sooner or later yield no crop at all. "If the elements are contained in the soil in sufficient quantities, it produces a rich crop; if it be defective even in one of those only, this is shown very soon, by the impossibility of growing on it certain kinds of plants."

Sulphated bones have been very much in vogue of late years as a manure for turnips. The introduction of this compost is due to Liebig, who treated of this subject in his grand work on agricultural chemisty; "The more finely bones are reduced to powder, the more easily are they assimilated. The most easy and practical method of effecting their division is to pour over the bones in a state of fine powder half their weight of sulphuric acid, diluted with three or four parts of water, and after they have been digested for some time, to add about one hundred parts of water, and to sprinkle this acid mixture before the plough." Many favourable accounts of this compost are given in Vol. 5 of the "Journal of the Royal Agricultural Society of England;" nevertheless a constant repetition of this manure upon the same cannot answer, as there are only three substances restored and removed. And, notwithstanding all that has been said regarding the efficacy of ammoniacal salts, nitrates of potash and soda, sulphates of potash and soda, soot, charcoal, &c., the day is not far distant when these old prejudices will be entirely dissipated; and that plants will be supplied with their appropriate food from chemical manufactories.

Regarding draining, I am convinced, from conversations with intelligent farmers, that if slowly disintegrating inorganic fertilizers are applied to a land, it cannot be over drained; but if soluble composts like guano, stable dung, and ammoniacal salts, are to be administered, the less drained the land the more durable the manure; it being well known that the watet, issuing from the drains of a land well incorporated with guano or stable dung contains quantities of potash, soda, lime, magnesia, sulphuric and, phosphoric acids and chlorine, which are the principal constituents in the great laboratory of nature for the sustenance of vegetable life. From the foregoing statements, the agriculturist will see that, to grow turnips to an indefinite period upon the same land, a mixture must be applied for each crop, consisting of potash, soda and lime, sulphate of lime, phosphate of lime and magnesia, phosphate of magnesia and ammonia, and silicate of potash; and if his land be well drained, the above salts must be so combined as to form a slowly disintegrating compost.

The following are the results of such a compound, collaterally with some where a mixture of stable and cow manure was applied. The soil is a very retentive clay with a close arenaceous bottom, and undrained; therefore, during the severe weather in September the water in parts of the field was four or five inches deep which must have exercised an injurious effect upon the growth of the turnips:—

				produce. tons.	cwt.
Stable and cow manure,	per acre. 15 tons	cost. £5 10 0	Tubers	18	2
	Labour	1 10 0	Leaves	2	14
		£7 0 0			
Liebig's Patent Manure	4 cwt.	2 2 6	Tubers	21 0	0 0
			Leaves	2 10	0 0

I found that the tubers taken from the field upon which Liebig's patent manures had been applied, contained the following per centages of alkalies and silica, which are appended in conjunction with the quantities of these constituents found by Boussingault in turnips:—

	Boussingault. A	Muspratt. B
Potash	46·48	42·54
Soda	7·15	16·76
Silica	9·53	4·98

The reader will see that the soda in B is little more than double that in A, which is interesting, as it agrees with the relative proportions of the alkalies in the manure administered. I have instituted a series of investigations, some of which are going on at present, with a view of determining to what extent soda may replace potash in turnips, potatoes, wheat, oats, beet, peas, beans, carrots, et cetera, and if it be possible to substitute the whole or even the half of the potash by soda, a grand object will be achieved, both by the philosopher and the farmer, as the former will find his theories corroborated by practice, and the latter his crops cultivated with much less expense.

I was surprised at the discrepancy of the silica in A and B, and, therefore, requested

my brother Frederick to make a second determination, which afforded him the annexed result:—

SILICA 5.20.

Numbers agreeing so closely with my own as to render a third determination unnecessary. It is well established by the analyses of Davy, Berthier, Sprengel, Will, and others, that the proportions of the different ingredients in the ash of a plant are generally affected either by the age the plant has attained, or by the seasons of the year at which the examination is made; but I should principally refer the variableness of the ingredients to the state in which the salts are present in the soil, as this must, in many instances, exert a marked influence upon the laws of substitution as well as upon the process of assimilation. The manure, for carrots, parsnips, beet, and other bulbous roots being so similar to those for potatoes and turnips, and the porous soil the one in which they flourish the best, I need not dwell any more upon this class of plants, whose cultivation I hope may increase, as they afford a palatable and excellent nourishment. I shall now proceed to the cereal grasses, of which the most commonly cultivated, and the most important as the food of man, is wheat, but in the north of Europe rye is extensively grown; its bread, however is much inferior in nutrition to that of wheat. It is a much hardier plant than wheat, and will thrive upon inferior soil, as arenaceous ones, while wheat delights in a stiff somewhat calcareous clay.

Barley also likes a light soil, but the oat will grow almost anywhere, which distinguished it from the other cerealia. The composition of all these plants is very analogous, but their exhausting properties differ widely, as will be seen from the annexed numbers which represent the quantities of inorganic constituents removed on an average from an acre, by each:—

No. 4.	Grain lbs.	Straw lbs.	In toto lbs.
Wheat	28½	160	188½
Rye	14¼	130	144¼
Oats	61	70	131
Barley	41	84	125

I shall now give Boussingault's, Will's, Fresenius's and Bichon's analyses of the first two; as for the oats and barley, I am not aware of any good analyses existing of them, but one may infer that the nature and proportion of their ingredients are analogous to those of wheat and rye:—

Wheat.

No. 5.	Fresenius and Will Giessen Grain	Boussingault Alsace Grain	Bichon Holland Grain	Mean of several analyses Straw
Silica		1·31	42	79·61
Phospheric acid	49·21	48·30	46·14	2·90
Sulphuric acid		1·01	·27	·99
Chlorine				1·38
Lime	3·09	3·00	3·91	
Magnesia	13·54	16·26	12·98	4·84
Iron	·36		9·50	
Potash	33·84	30·12	6·43	10·02
Soda			27·79	·26
	100·04	100·00	107·44	100 00

The above table shows that the principal ingredient taken off in a crop of wheat is silica, which the farmer scarcely ever thinks of returning to his soil. Guano does not contain any silicates; thus, when a farmer has manured his wheat fields for some time with this deposit, he complains of slender stalks, and no wonder, when, in luxuriant growth, their ashes contain 67 per cent. and upwards of this valuable substance. The quantity of silica taken from an acre, in a crop of wheat, generally averages 132 lbs.; therefore, to restore this to the land the farmer must add, besides guano, two hundred pounds of silicate of potash or soda, a salt which is now an article of commerce. Wheat is a great exhauster of the soil, and especially of the first ingredient in Table 5, and on this account it is one of the most difficult crops to grow, year after year, upon the same soil, for, if we suppose in an acre of land there are about 378 lbs. of available silica, this quantity could only serve for two crops of wheat, consequently, to bring the soil into a proper state for again growing any of the cereal grasses, it would have to lie fallow for a length of time, and if the district were feldspathic, lime would necessarily heighten its productiveness.

Sir,—Having pointed out the utter impossibility of growing to advantage cereal grasses with guano, PER SE, it necessarily follows that the farmers must very shortly either give up the use of this fugitive manure, or else apply it to their land in conjunction with silicated, carbonated, and phosphated alkalies.

Many persons, on reading my letter, will probably have said that the statements advanced were, as yet, merely hypothetical but I have fortunately just noticed a practical corroboration of my views in the "Gardeners' Chronicle," an extract from which I shall introduce, in order to prove how prac-

tice corresponds with theoretical deductions. "At the great jesuit convent at St. Diego, Upper California, the Jesuits have known the use of guano as a manure ever since the beginning of last century. M. La Pulle, lately sent there as an enquirer by the Colonial Office, had opportunities of speaking with the Superior on the subject. He relates that, after the use of guano for several years (four or five), the soil naturally fertile, and very like that of the best cultivated parts of Norfolk, becomes rapidly exhausted, and unable to yield even a meagre crop; so that, while under the influence of guano, the crop was no less than 120 bushels of Indian corn per acre, (considerably more than double the crop yielded by prime land in Louisiana and the Arkansas), yet after a short period of such exhausting treatment the constituents or properties of the earth became worn out, and the soil literally (and without any figure of speech) barren.

"In California the proprietors are possessed of so extensive a territory, that the loss of the land is to them a matter of little moment—knowing from practical experience, the extent to which this manure is coming into vogue, and that some farmers are thoughtlessly applying it to land of every description, and in large quantities, hoping for an easily and large return. I have thought it my duty not to conceal these facts from the public."

There can be no doubt as to the truth of M. de Falle's statements, for if a soil be deficient in silicates magnesia and alkaline carbonates, and a manure also lacking these essentials is administered to it, how can it for years yield the farmer a profitable return? The quantity of a substance used, is no criterion as to its excellence, for if we only call to mind the enormous quantities of nitrate of soda that were recklessly thrown upon the land some years back, we find that the consumption of an article as manure for a certain period, is no proof of its ultimate efficiency and duration. There is a paragraph going the round of some of the papers recommending soap as a manure!! What will be the next suggestion? Probably mesmerised seed, requiring soil, neither for their support, nor any food for their maintenance.

Stable dung is an excellent manure for the cereals, as it contains a large proportion of silica, beside other valuable constituents. Its mechanical effect also upon the stiff clay soil is very serviceable: for the best and most powerful manuring will have little effect unless the physical condition of the soil is strictly attended to. The state of a field has an enormous influence upon its productiveness, and it is for this reason that poor soils, of no great fertility in themselves, often yield more luxuriant crops than rich clay lands, on account of the rain and atmosphere percolating through their pores, and coming in immediate contact with the root, whilst moisture on a retentive soil often evaporates before it has had a sufficient time to penetrate it. These inconveniences are, however, fast disappearing, owing to the ingenious and superior implements that are daily brought to the assistance of the agriculturist for pulverising his clay; and also through the system of draining now extensively followed. There is a great loss of alkaline salts when stable dung is applied upon well drained land, therefore, if the farmer were to collect the saline liquid issuing from his drains and use it for irrigation, he would soon find the benefit of such a procedure. Before leaving this subject I must state, that the tobacco plant requires a similar manure to Rye (Table 5,) and that they both delight in a rich light soil. Many manures have been tried in Germany, and elsewhere, for tobacco, but with very little success; the best compost for this plant is that which contains alkaline carbonates, magnesia, lime, gypsum, &c. The best analyses of this plant are from the Giessen laboratory. The samples sent to Baron Liebig were Hungarian, and he handed them to Professors Will and Fresenius. I have appended five out of their ten analyses, in order to show, to those interested in the cultivation of this plant—where the tobacco grew upon an argillaceous soil—the lime, magnesia, and chlorides—also how essential it is in manufacturing an artificial manure to have prescience of the nature of the land upon which it is to be applied.

Analyses of Tobacco.

No. 6.	I.	II.	I.	II.	III.
Potash	29·08	30·07	9·68	9·36	10·37
Soda	2·26				
Lime	27·87	24·79	49·28	49·14	39·53
Magnesia	7·22	8·07	14·56	15·59	15·04
Chloride of Sodium	0·91	6·45	4·81	3·20	6·39
Chloride of Potassium			4·44	3·27	2·99
Phosphate of Iron	8·78	6·03	5·19	6·72	5·56
Sulphate of Lime	6·43	5·60	6·08	6·14	9·42
Silica	17·65	18·99	5·54	6·28	8·34
	100·00	100·00	100·00	100·00	100·00

Having now given the analyses of the cereals and tuberous plants, I shall introduce Dr. Richardson's analyses of farm yard manure:—

1. Fresh.

Water	64·96
Organic matter	24·71
Inorganic salts	10·33
	100·00

2. Dried at 212 degrees.

Carbon	35·49
Hydrogen	5·27
Oxygen	25·52
Nitrogen	1·76
Ashes	30·05
	100·00

A.—INORGANIC MATTER.

a. Portion soluble in water.

Potash	3·22	
Soda	2·73	
Lime	0·84	
Magnesia	0·26	
Sulphuric acid	2·25	
Chlorine	3·15	
Silica	0·04	13·00
Carbonic acid	86·99	
	100·10	

b. Partially soluble in muriatic acid.

Silica	27·01
Phosphate of lime	7·11
Phosphate of magnesia	2·26
Phosphate of iron	4·68
Phosphate of manganese	trace.
Phosphate of alumina	trace.
Carbonate of lime	9·34
Carbonate of magnesia	1·63
Sand	30·99
Carbon	·83
Alkalies and loss	3·14
	86 99

It is evident that stable manure contains all the necessary ingredients for the support of vegetable life, but the quantity usually applied to the acre is not sufficient to yield alkalies to a large crop of tuberous plants. This might not be noticed for a series of years upon rich soil, but if it were administered for two or three successive seasons upon scanty soils, and 18 to 21 tons of turnips abstracted each harvest, the impoverishment of the soil would necessarily become visible, and the farmer on reflection would discover that the 20 tons of manure given contained 134 lbs. of potash and soda, while each crop of tubers required 182 lbs. of the same metallic oxides. The other ingredients, however, are present in sufficient quantity for any crop, i. e. if 20 tons of the stable dung are yearly given to the acre. By a partial supply of the alkalies, the equilibrium of fertility is not restored; and with regard to guano, "if we supply this alone we do not act wisely, because we consume our capital by rich interests, and leave to our children an exhausted soil." I shall now annex two analyses of guano, the manure which has of late years created such a furor in the United Kingdom:—

	I.	II.
Moisture and combined water	22·200	21·610
Potash	4·371	1·144
Soda	·857	2·420
Ammonia	6·682	5·434
Magnesia	·802	·784
Lime	11·272	15·356
Hydrochloric acid	1·750	2·214
Sulphuric acid	3·040	2·109
Oxalic acid	6·470	12·360
Phosphoric acid	14·922	16·339
Organic matter and water	4·952	11·556
Animal matter and water	1·331	·740
Humus	2·000	2·000
Uric acid	16·523	2·308
Sand, et cetera	1·509	1·645
Loss	1·26	·352
	100·000	100·000

Mr. Denham Smith, who analysed numerous varieties of South American guanos, states that the above specimen on which I have placed second was considered by the importers to be of a very superior quality. If this were the case, and turnips had been manured with it two years successively upon poor land, I pity the farmer that bought it, for the crops he harvested must have completely exhausted his soil of alkalies, the constituents of every useful manure, for through their presence the virgin condition of a soil is preserved. The uric acid in No. 1 is eight times as much as in No. 2, evidently showing that the latter must have been more exposed to the air, and consequently its uric converted into oxalic acid. I have recently investigated several samples of this deposit, but could not detect a trace of uric acid in them. Some chemists judge of the excellence of guano by the quantity it contains of this acid, which appears to me to be very erroneous, for the effects of uric acid upon vegetation have never come to light. I thought Dr. Ure would have pursued this path, but I suppose the opinions that Baron Liebig advanced during the meeting of the British Association, at York, stopped the Doctor from giving to the public any further observations upon the subject. Guano also contains very little magnesia, which plays a grand part in vegetation, for it enters very largely into the various graminæ.

The phosphates of magnesia and lime are invariably found in the largest proportion in the seed, and are indispensable for their production; and appearing in this form, they serve an all-wise purpose of the Great Disposer of events, namely, that of furnishing to animals the materials of which their framework is formed. Five cwt. of guano only contain 4 lbs. of magnesia, while a crop of turnips removes 15 lbs. of this earth from the soil, consequently a great exhaustion takes place. The most economical way for the farmer to supply his land with magnesia is by using the addition of a certain quantity of Epsom Salts. I shall now proceed to the leguminosæ, of which class the bean

and pea are the most prominent. The mode of cultivating beans is very varied, and greatly influenced by climate, and therefore, the farmer of each country is obliged to suit his practice to this circumstance. The bean ripens very slowly, and for this the prevailing practice in England is to sow it very early in spring. The bean, like wheat, delights in a stiff clay, upon which it is either drilled, or sown broad cast, but which is the better method can only be decided by experience. The pea adapts itself to almost any soil, and as it does not strike down like the bean, a deep ploughing is not required to fit the land for its reception. The common vetch will grow almost anywhere, and is very similar in its composition to the pea. It is grown exclusively for the use of cattle, forming an excellent nourishment. The composition of these plants are so analagous, that I shall merely append Horting's analysis of the pea, and subsequently, analyses by other chemists of this plant grown in different localities, with the view of affording the agriculturists an insight into the essential constituents of the pulse crops:—

CONSTITUTION OF THE PEA WHEN TAKEN OFF THE FIELD:

Moisture	8·60	11·80
Organic Matter	88·66	78·20
Inorganic Salts	2·74	10·00
	100·00	100·00

CENTESIMAL COMPOSITION OF THE INORGANIC SALTS:—

	Grain.
Phosphate of Potash	46·65
Phosphate of Soda	11·31
Phosphate of Lime	9·69
Phosphate of Magnesia	18·36
Peroxide of Iron	0·98
Chloride of Sodium	2·17
Sulphate of Potash	9·57
Silica	0·56
Loss	·51
	100·00

Wheat.	
Carbonate of Potash	4·16
Carbonate of Soda	8·21
Carbonate of Lime	47·55
Phosphate of Lime	5·17
Phosphate of Magnesia	4·37
Phosphate of Iron	0·90
Phosphate of Alumina	1·20
Chloride of Sodium	4·63
Sulphate of Potash	10·75
Magnesia	4·05
Silica	7·81
Loss	·90
	100·00

TABLE SHEWING THE PER CENTIC COMPOSITION OF THE ASH OF PEAS IN DIFFERENT LOCALITIES:—

	Fresenius & Will Giessen.	Boussingault Alsace.	Bichon, Holland.	Thon, Kurhessen.
	Grain.	Grain	Grain	Grain
Potash	39·51	36·31	34·19	35·20
Soda	3·98	2·56	12·76	10·32
Lime	6·91	10·39	2·46	2·70
Magnesia	5·43	12·24	8·60	6·91
Peroxide of Iron	1·05	——	0·96	1·94
Phosphoric Acid	34·50	31·00	34·57	34·01
Sulphuric Acid	4·91	4·33	·356	4·28
Chlorine	3·71	1·18	0·31	2·56
Silica	——	1·54	3·25	0·29

The preceding table shows, that plants of the same species when cultivated upon various soils, yield ashes differing very slightly in composition; therefore, wheresoever the pea, beans, or vetch be grown, the fertilizer administered must consist of alkaline carbonates, phosphates of the alkalies and earths, small quantities of silicate of potash sulphates and chloride of sodium, i. e. if the farmer wishes to restore to his field its primitive condition and thus keep it in a high state of culture. The leguminosæ are great exhausters of the soil, for a good crop of peas abstracts 290 lbs. of inorganic salts from the acre only a quarter of which are generally restored, consequently these plants require a plentiful manuring, which it is impossible to supply them with by guano. "If we recollect that the favourable effect of guano upon our fields depends on its amount of ammoniacal salts, of alkaline phosphates, and the other mineral constituents of the seeds, but that it is deficient in alkalies, the principal constituents of the herbs, straw, and roots, it is easily understood why the opinions of farmers on the value of guano, as a manure, are so contradictory;" moreover, there are scarcely two specimens in the market, possessing the same composition, for some samples contain five per cent. of potash, and others barely a trace. Before concluding, I beg to call the attention of the thinking public to popular lectures upon Agricultural Chemistry which to me have always appeared "stale, flat, and unprofitable;" for although they may sometimes instruct for

the moment, still the farmer never has time to catch and think over what the lecturer has stated. Useful information can only be properly given in journals, for there the agriculturist has an opportunity of pondering over what is advanced, and if it does not meet with his own ideas and experience, he has the opportunity of laying his views before the public through the same medium. I regard popular discourses as a means of exciting, not of satisfying, a rational curiosity; they often promote a taste for science, but never teach it. Scientific men must be greatly pleased, to see the taste for chemistry that has of late years been imbibed in the United Kingdom; and this is as it should be, when we find this science intimately amalgamated with all others. By a knowledge of chemistry, our acquaintance with nature and her laws is so much extended, that we are enabled, in numberless instances not only to apply to the most profitable purposes the knowledge we have thus embraced but to determine antecedently with sufficient accuracy the termination of every new application; in fact, the objects of chemistry are inexhaustible, for it ventures to examine the matter of which trees, vegetables, rocks, animals, and even the atmosphere, are respectively composed, and it seeks to ascertain their qualities, the number of their elements, the idiocrasy of these, and the properties of every other compound which can be produced by their union, and for this demands, on account of its vast utility, the notice of mankind. Its usefulness, though often unacknowledged, is everywhere felt. So great is the service of a knowledge of this science to the physician, that now its practical acquisition forms an essential part of his education. What immense influence does it not exercise upon geology, metallurgy, mineralogy, the manufacturing of soda, soap, sulphuric acid, glass, porcelain, even baking, brewing, distilling, dying, bleaching, depend entirely upon chemical principles; and as to the advantages arising from its applications to agriculture, these are now becoming universally acknowledged. This last path was first struck out by the immortal Davy, but all our recent knowledge in this direction has been culled from the precious works of Liebig, whose name will be inscribed upon the lasting scroll of fame as a glorious benefactor to the world. It is only by properly pursuing science that the mind of man can form any commensurate conception of the beneficence and unfathomable wisdom of the great Creator of the universe.

Yours, &c.,

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EBELMAN'S SILICIC ETHERS.

CAUTIOUSLY pour pure alcohol into chloride of silicium: a vivid reaction takes place, with a very abundant disengagement of hydrochloric acid gas, and a considerable reduction of temperature, when, the weight of the alcohol added, rather exceeds that of the chloride of silicium,* no further disengagement of gas is perceived, and the liquid becomes very sensibly warm. If it be submitted to distillation, there passes over a certain quantity of hydrochloric ether, and then, the greater part of the liquid contained in the retort distils, between 320° and 340° F.: the latter product is to be set aside, and the distillation is to be continued, until it terminates at above 570° F.; there remains a mere trace of silica in the retort.

The product distilled, between 320° and 338°, is rectified until its boiling point becomes fixed, between 323° and 325°; by this, a colourless liquid is obtained, possessing a penetrating and ethereal odour, and a strong hot taste, its density being 0·932. Water does not dissolve it, and decomposes it very slowly, with a deposit of silica; it is perfectly neutral to test papers; alcohol and ether dissolve it in all proportions; the alcoholic solutions of the alkalies decompose it rapidly, and, by means of acids, silica is separated in the gelatinous state. When a few drops are thrown upon red-hot platina, they burn with a white flame, depositing silica in a state of impalpable powder.

The analysis of this compound shows, that it contains carbon and hydrogen, in the same proportions as in ether, and that the silica contains the same quantity of oxygen as the base.

If, then, 277·32 be admitted as the equivalent of silicium, as allowed by most chemists, and SiO^3 for the formula of silica, that of the ether will be $SiO^3, 8C^4\,HO$. If, on the other hand, we take the third of the preceding number, or 92·44 as the equivalent of silicium, and SiO^2 as the formula of silica, as proposed by M. Dumas, according to the density of the vapour of the chloride of silicium, the formula for silicic ether will be similar to that of the other compound ethers, and represented by $SiO\,C^4\,H^5\,O$.

The density of its vapour was found to be 7·18; calculation gives 7·234, admitting that $SiO\,C^4\,H^5\,O$ represents a volume of the

* Chloride of silicium may be obtained, by passing dry chlorine over an intimate mixture of silica and finely-divided charcoal, in a red-hot porcelain tube, the chloride may be condensed in a properly cooled receiver: as it generally contains excess of chlorine, it may be agitated with a little dry mercury and re-distilled.—*Quested.*

vapour; this mode of condensation has not been hitherto observed in compound ethers.

On receiving, in separate portions, the product, distilled between 338° and 570°, it was found, by analysis, that the carbon and hydrogen were constantly in the same proportions in the ether, but the proportion of silica increased with the temperature. The liquid distilled at above 520° is colourless, and has a weak smell, and a taste different from that of the ether above described. Its density is 1·035. The action of water, and of the alkalies upon this compound, is perfectly similar to that upon the ether, $SiO\ C^4\ H^6\ O$; its analysis indicates its formula to be $(SiO^2)\ C^4\ H^5\ O$.

Silicic acid forms, then, at least two ethers, and their formation is readily explained by the two following formulæ:—$SiCl + C^4\ H^6\ O^2 = H\,Cl + SiC^4\ H^5\ O$, $(SiCl^2) + 2\ C^4\ H^6\ O^2 = C^2\ H^5\ Cl + H\ Cl + HO + (SiO^2)\ C^4\ H^5\ O$.

It is to be remarked, that, during the reaction of alcohol on the chloride of silicium, hydrochloric acid is disengaged, only as long as the chloride is in excess; and it is only when the last portions of alcohol have been added that hydrochloric ether can be obtained. According to the formula 1 equivalent of alcohol, 575, must be employed for one equivalent of chloride of silicium, 535, these were, in fact, the proportions of the two bodies that were made to act upon each other.

IMPROVEMENTS IN TREATING CERTAIN METALLIC ORES, AND REFINING THE PRODUCTS THEREFROM.*

BY FREDERICK BANKART.

THIS invention relates to all ores containing copper, whether combined with sulphur or not; and consists in adjusting and mixing together the different ores in such a manner, that those ores which contain sulphur in excess may compensate for the deficiency of sulphur in the other ores, and submitting the ores, so adjusted and mixed, to successive roastings and lixiviations, whereby a solution of sulphate of copper is obtained, from which the copper may be precipitated in a refined metallic state.

The method of carrying out this invention is as follows:—The copper ore is first reduced to powder, and the relative proportions of sulphur and copper which it contains are ascertained by analysis; then, if the sulphur bears a less proportion to the copper than one to two, iron pyrites or copper pyrites, also pulverised, are added, in such quantities as will bring it to that proportion. If two or more descriptions of copper ores are to be treated, they must be mixed together in such proportions as will make the sulphur of the mixture bear to the copper at least the proportion of one to two; iron pyrites or copper pyrites being added, where necessary, to ensure that proportion of sulphur. And there must always be a sufficient quantity of sulphur ores for the conversion of the copper into a soluble sulphate, and also to allow for the escape of part of the sulphur during the processes. The copper ore, prepared in this manner, is then submitted to such a degree of heat, in free contact with atmospheric air, as will oxidize the metals not already in a state of oxide, and convert the sulphur into sulphuric acid. For this purpose, a common reverberatory furnace is used, and the ore submitted to a dull red-heat, in free contact with the air, until the mixture attains a state of seeming fluidity, and it is retained in that state until the evolution of sulphurous vapour nearly ceases: the whole of the mixture is not put into the furnace at once; but it is divided into several portions, and one portion being put into the furnace, another is added when the first has attained a dull red-heat, and so on until the whole has been introduced;—the mixture is frequently stirred during the process. The evolution of sulphurous vapour having ceased, or nearly so, the mixture is removed from the furnace to a vat or pit, and water (or a weak sulphate liquor from a previous lixiviation) applied at about the boiling temperature, and retained at that temperature for some time, by means of injected steam, to ensure the solution of the sulphate of copper. When the sulphate of copper liquor is drawn off from the residual mixture, the latter is mixed with as much iron pyrites or copper pyrites as will supply the requisite proportion of sulphur; the whole is then subjected to a second roasting, and to a second lixiviation: this process of adjusting the proportion of sulphur in the mixture, and roasting and lixiviating, is repeated until the whole of the copper is obtained from the ore.

The next process is to precipitate the copper from its sulphate solution; after which it is to be fused, and run into moulds; it is then ready for sale as fine metallic copper. Various modes of precipitation may be adopted; but the patentee prefers to employ cast or wrought-iron plates, keeping the solution at a temperature of from 120° to 150° Fahr., and as nearly as may be of the same strength, by means of a circulating stream of fresh sulphate solution, which, entering at

* *Newton's Journal.*

ON THE VESICULAR ... OF MILK.

... The Academy of Sciences ... 5th January last, M. Gros ... presenting an essay on the ... conclusions at which he ... showing ...

1. The globules of milk are formed of the buttery substance enclosed in vesicles analogous to those of the vitellus.

2. The vesicular tunic, which has been so much disputed, and is difficult of exhibition by means of acids and alkalies, becomes coloured by iodine, after the reaction of chlorine.

3. The greater portion of the vesicles of new milk contain a small quantity of carbonic acid.

4. The butter vesicles are produced on the internal walls of the mammary utricles, which, during the period of lactation, form vesicles, resembling the ovaries; burst, and pour their contents, along with the granulation and the butter vesicles, into the lactiferous tubes.

5. The granulous substances of the colostrum are no other than small utricles with their internal vesicles.

6. When lactation terminates, the buttery substance is reabsorbed in the same manner as the vitellus in the ovary; nothing remains excepting the utricular and vesicular tunics, which offer various phenomena of reabsorption in the after milk.

7. The vesicles of milk are not apt to be converted into blood vesicles; which also have their vesicular reproduction.

NOTE ON AN APPARATUS FOR BAKING BREAD BY MEANS OF STEAM.*

BY M. VIOLETTE.

The apparatus, says M. Violette, is composed of two concentric cylinders, between which the steam may circulate, the latter having been raised to a proper degree of heat in a small spiral tube, kept to a proper temperature. The inner cylinder is pierced with an infinite number of microscopic holes, and contains the dough. The steam that circulates between the cylinders passes through these holes to the interior, and there distributes the heat in a perfectly uniform manner, and escapes by a small external opening; after having exercised its calorific action, by which the bread is cooked in less than half an hour. Thus nothing is more simple than the process. To introduce the dough, to close the apparatus, to turn the cock, to admit the steam, to turn it off after a sufficient time has elapsed, to withdraw the bread properly cooked, to replace it immediately by another batch. Such is the simple and easy progress of the operations.

* *Comptes Rendus*, Feb. 23, 1846.

A NEW PERAZOTIC PRODUCT, AND ITS APPLICATION TO THE ARTS.*

BY JOHN EVANS.

This invention relates to the preparation of an artificial manure. The materials employed are: first, animal matters, consisting of muscular fibre, flesh, blood, serum, sour milk, old skins, fish, urine, horn, old woollen rags, refuse of soap boilers, of slaughter-houses, and of tallow and candle manufactories; secondly, vegetable matters, consisting of humus, rotten or decayed wood, the produce of dunghills and stables, the waters of manufactories where starch and prussiates are made, the waters of dyers, brewers, distillers, and refiners' establishments, and the ammoniacal and other liquors from the gas works; thirdly, mineral substances, consisting of ashes containing potash, soda, phosphates, and silicates.

To convert animal matters into manure, and render them of easy transport, without creating a nuisance or affecting the public health, they are first treated with a decoction of oak bark, combined with about one-tenth of its volume of pyrolignite of iron. This mixture is put into a suitable vessel, and the muscular parts of animals, fish, blood, the remains of skins, and entrails being introduced, are allowed to remain for three days; after which they are taken out and dried, either in the open air, or by the application of heat; they are then free from any fetid odour, and can be easily reduced to powder. A solution formed by dissolving equal parts of sulphate of iron and alum in water, or a mixture of naphtha (to which a small quantity of nitric acid is added), saturated with lime, may be substituted for the decoction of oak bark and pyroligneous acid.

The same results may be obtained by pouring into cesspools, sewers, &c., in small quantities, either a decoction of oak bark, mixed with a solution of sulphate of iron and alum, or naphtha combined with lime, and treated with nitric acid, with one-tenth of its weight of sulphate of iron. But before the disinfecting agent is introduced into cesspools, &c., muriatic acid may be injected, in small quantities at a time, into the open part of such receptacles.

Pure urine, or urine containing a small quantity of feculent matter, should have a little of the disinfecting agent added to it before being removed from the place where it is collected, in order to carry off the fetid gases. It is then introduced into a vessel

* *Newton's Journal*.

with a lid, resembling a still-head, and furnished with a tube to carry the gases to the bottom of a butt or vessel, two-thirds full of sulphuric acid, diluted with water, and to every 1,000 quarts of the liquid contained in the vessel above-mentioned, are added 10lbs. of a composition, formed by boiling 12 parts of water, 3 of sulphuric acid of 66°, 2 of fresh bones, in a leaden boiler for seven or eight hours. When this matter has been introduced into the boiler, the mixture is allowed to stand for two or three hours; 1lb. of magnesia is then added, and the whole evaporated to dryness.

The herbs and plants of which the dung-hills of farm-yards are formed are made into heaps in the following manner:—The dung-hill being commenced in the ordinary way, a layer of dung, sprinkled with ashes, (to which has been added about 25 per cent. of solid offal, arising from the refuse of dyers, manufacturers of prussiates, and tallow melters,) is successively added to the top of the heap; openings are formed, communicating with the interior, to allow the gases to escape, or the liquid products above named to be poured on the heap to quicken the fermentation and decomposition of the vegetable matters; and steam-pipes are made to pass through different parts, so as to impart a heat of from 15° to 18° to the mass. The fetid exhalations will be prevented, and the richness of the manure increased, if the whole of the surface, except those portions reserved for the escape of the gases and the introduction of the liquid products, be covered with a mixture of tar and lime. When the decomposition is complete, the mass may be dried, and reduced to powder; then, by mixing this powder with the disinfected animal matters, the new manure is formed, which the patentee terms "British guano."

The patentee claims the mode or modes of making the manure above-described.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE FORMATION OF VOLATILE OIL IN DRY ANTISCORBUTIC PLANTS.*

BY M. F. N. LEPAGE.

It has, for a length of time, been generally believed by all pharmacists, even the most modern, that, after desiccation, antiscorbutic plants, such as wild radish, scurvy grass, and water-cress, lose all their medicinal virtue, which, as we know, resides chiefly in an acrid and sulphuretted volatile oil. In this essay I shall prove, that if, for a time, many observers have ascertained that the above-named dry plants yielded by distillation with water, merely an insipid and inodorous product, that it evidently arose from their having operated upon them under unfavourable circumstances.

In the month of September, 1843, I dried the roots of the wild radish, scurvy grass, and water-cress, for the purpose of making experiments on them at another time.

First Experiment.—Fifteen days after they were dried, I submitted each of these plants to distillation with water, but without previous maceration in cold water, and I obtained hydrolates having a faint smell, and being nearly insipid.

Second Experiment.—I took the same plants, which had been dried fifteen days, and subjected each of them to maceration in cold water for four-and-twenty hours. During their contact, each of them gave out the pungent smell peculiar to each species, and their macerations, whendistilled over an open fire, yielded milky hydrolates of a very pungent smell, which, compared with that of the green plants (using the same proportions let it be understood), were found by many persons, not informed of the circumstance, to whom I presented them as absolutely identical. The hydrolate of the water-cress was indisputably more milky and more pungent than that obtained from the fresh plant.

Third Experiment.—Six months after they were dried, in the month of March, 1843, I experimented again on the same plants; after a maceration of four-and-twenty hours in cold water, the hydrolates I obtained appeared to me less acrid, and less milky, in the case of the radish and scurvy grass alone, than those furnished by the same plants in the second experiment. As

* *Jour. de Chim. et Med.*, March, 1846.

to the hydrolate of the cress, it was as milky and acrid as before.

Fourth Experiment.—I took the same plants, six months after desiccation, and I placed each of them in cold water, to which I had added a small quantity of an emulsion of white mustard seed; I then, after a maceration of four-and-twenty hours, submitted them to distillation, and I obtained hydrolates, exactly the same as those in my second experiment, in the cases of the scurvy grass and radish. As to the hydrolate of the water-cress, it was the same as that I obtained from the same plant, without the addition of the emulsion of white mustard seed; this reaction of the latter substance had been already noticed by M. Simon, of Berlin, in the case of scurvy grass.

Fifth Experiment.—I added an emulsion of white mustard seed to a cold decoction of the radish, an infusion of scurvy grass, and another of cress, in boiling water. The infusions had been previously allowed to cool, that the mustard emulsion might not coagulate. An extremely acrid and pungent smell was developed in each of the infusions; I then, after submitting all the three to distillation, obtained acrid and milky hydrolates.

Sixth Experiment.—I placed a quantity of radish, scurvy grass, and cress, in maceration, in alcohol at 85° for four-and-twenty hours; at the end of that time I distilled the macerations in a hot-water bath, and I obtained, as I expected, perfectly inodorous alcoholates, nor was the taste of the alcohol in any respect changed. The residue, when evaporated to get rid of the alcohol it might contain, was then diluted with water, to which I had added the emulsion of white mustard seed. The essential oil was soon apparent, but less so than in a watery infusion of the same dried plants. The cause of this is that the alcohol, perhaps, is less capable of dissolving the principle which, in antiscorbutic plants, gives birth to the essential oil, under the influence of the mustard emulsion. This is easily proved by treating these same plants, already macerated in alcohol, with water and mustard emulsion. In this case we perceive that they still yield a considerable quantity of essential oil.

Seventh Experiment.—I asked myself whether the property of developing the volatile oil in infusions of antiscorbutic plants, which had been previously dried, belonged exclusively to the emulsion of mustard, *Myrosyne*, of M. Bussy? I thought I should be able to discover this property in the fruit of other cruciferous plants, and experiment has confirmed my ideas: I am, in fact, certain that we could obtain a similar reaction with emulsions of the seeds of the following cruciferous plants:—

Small red radish (Raphanus sativus radicula).

The *raifort* of the Parisians (Raphanus sativus niger).

Cabbage (Brassica oleracea).

Sauce alone (Erysimum alliaria).

Cuckoo flower (Cardamine pratensis and amara).

And, also, with the seeds of Brassica napus and Brassica campestris, the only seeds I have experimented on. But as they have all produced a similar result, I think I may infer from this circumstance, that all the seeds of the very natural family of the cruciferæ, or nearly all, possess this property.

Several attempts I have made with other emulsive seeds, but not belonging to the cruciform family, have yielded negative results.

Eighth Experiment.—I have satisfied myself, in a direct manner, that strong acids, caustic alkalies, alkaline carbonates, metallic salts, the salts of copper, mercury, and silver are opposed to the development of the volatile oil by the action of water, whether in the case of plants recently dried, or of those which have been long dried, and when the emulsion of white mustard has been added to the macerated mass.

The above experiments touching the conditions under which, by the action of water, dry antiscorbutic plants can give out essential oil, showing that these conditions are absolutely the same as those which are necessary for the development of the essence in black mustard. These conditions, I say, made me imagine that the myronate of potash, discovered by Professor Bussy, in black mustard, might also be found in these plants; but the experiments I have made to extract this salt from the radish, and which I will here notice merely for the purpose of guiding those who wish, in their turn, to make experiments on this principle, led me to no satisfactory result.

I caused one kilogramme of fresh radish to be dried; by this operation it was reduced to 260 grammes; I had it pulverised and placed in an apparatus, by which it could be constantly moved; I afterwards wetted it with a small quantity of alcohol at 70°, for the purpose of coagulating the myrosyne and preventing its reaction on the other principle, with which, by the action of water, it gives birth to the volatile oil. That being done, I submitted the residue to pressure, and had it dried in a stove; finally, I treated it several times with warm distilled water until it had lost the property of giving out the essential oil, by its contact

with the myrosyne of white mustard. All the watery liquids, when added together, were evaporated in a water bath until they were of the consistence of syrup. In this state the residue of the evaporation, excessively viscous and smelling strongly of radish, was divided into two portions, A and B.

The portion A was treated with alcohol at 22°, for the purpose of precipitating the glutinous matter; it was filtered, and again concentrated, to drive off the alcohol, but the liquid being found by this addition of weak alcohol, but very imperfectly deprived of its viscous matter; alcohol was added a second time at 90°, and, immediately, a precipitate was formed, which adhered to the sides of the vessel, and the liquid became perfectly transparent. After a moment's delay it was separated from the precipitate, and again properly concentrated by means of a gentle heat; it was then placed in a cool place for a month.

After this lapse of time, the liquid, when again examined, was found to have formed two layers, the undermost, in small quantity, was whitish, of the consistence of honey, and having no appearance of crystallisation; the upper layer was in much larger quantity, transparent, and sensibly acid on application to blue paper of turnsol. To decrease the volume of the lower layer, the vessel containing it was plunged, for about six hours, in a mixture of pounded ice and sea-salt; but, notwithstanding the lowering of the temperature, this layer was not sensibly decreased. Seeing that I could not succeed in obtaining the salt in a crystallised state, I separated the two layers, by decantation, to examine each of them separately. The lower layer, a small quantity of distilled water having been added, was dissolved in it, and the tests applied showed that the the deposit was merely part of the inorganic salts, naturally contained in the radish, which were separated from the solution when it was very much concentrated; they consisted of chloride of potassium and calcium, without any trace of sulphates, the latter having been eliminated by the alcohol.

The upper superincumbent layer contained the same salts, and developed the volatile oil by contact with the myrosyne. A portion of it was evaporated in a water bath to the consistence of honey. The extract, spread out on saucers and dried in a stove, appeared under the form of scales of an amber colour, and transparent. This extract was scarcely at all deliquescent in the air, but extremely soluble in water, the solution was very transparent and slightly acid when applied to turnsol paper, but it gave out no essential oil by contact with myrosyne.

I must observe, also, that the gelatinous matter previously mentioned, precipitated from its watery solution by alcohol at 90°, produced a transparent solution in water, in which the myrosyne did not produce the acrid and pungent odour.

The portion of the solution, B, was treated with hydrate of lead for the purpose of separating the glutinous matter. It was filtered to separate the precipitate; we then passed through the liquid a current of hydrosulphuric gas to precipitate the traces of lead that might remain. Again filtered and properly concentrated, this liquid was left to itself in a cool place for a month. After that lapse of time it offered the same characters as the preceding: separation into two distinct layers, chlorides and sulphates by tests, essential oil by the addition of myrosyne; finally, a part of it being reduced to the state of dry extract, the solution of the latter in water had not the same property.

Then it was, being possessed of these facts, I imagined it might be possible to obtain with dry antiscorbutic plants, the medicaments of which these plants form the basis when in a green state; my experiments on this subject have confirmed what I anticipated.

ANTISCORBUTIC SYRUP.

	grs.
℞ Root of wild radish* . .	320
Dry leaves of scurvy grass .	120
,, water-cress .	100
,, marsh trefoil .	140
Seville oranges	1000
Fine cinnamon	30
White mustard seed . . .	40
Rich white wine . . .	4000
Sugar	4000

The radish, the scurvy grass, and watercress, are cut small and placed in a water bath, in a covered vessel; on the other hand, the white mustard seed is bruised, with a drop of water, so as to form a homogeneous paste, this last is diluted with a sufficient quantity of water, the emulsion is strained through a piece of linen, and it is poured over the plants in the water bath; the vessel is then carefully closed, and the whole are allowed to macerate for four-and-twenty hours, at the expiration of that time, we add the marsh trefoil, the Seville oranges, cut into small pieces, and the wine; it is again allowed to macerate for four-and-twenty hours. At the end of that time, it is distilled in a water bath, to remove

* The quantity of dry plants mentioned in this formula represent about 1 kilogramme of the same plants in a green state.

1 kilogramme of the aromatic milky liquor, in which we melt, in a close vessel, 2 kilogrammes of sugar. The remainder of the operation is completed in the usual manner.

If we operate with recently dried plants, it will be almost unnecessary to employ the emulsion of white mustard seed; but, as in those cases, where it is perfectly useless, it is also equally certain it is not injurious, I think, in every case, I ought to recommend its employment.

Although there is not, in my opinion at least, a very sensible difference between the syrups prepared by this formula, and that obtained from recent plants, I still do not think it ought to be substituted in laboratories, before clinical experience has proved that it acts in a similar manner.

ANTISCORBUTIC WINE.

Antiscorbutic wine may also be as easily prepared with dried, as with green plants. If we use them when recently dried, it will be sufficient to cut them small, and soften them by pouring a little water over them. After four-and-twenty hours contact, the other plants must be added—the black mustard, the sal ammoniac, the wine, and the compound alcoholic tincture of scurvy grass: allow them to macerate for eight days and filter.

COMPOUND ALCOHOLIC TINCTURE OF SCURVY GRASS.

We take dry radish and scurvy grass, cut them extremely small, wet them with a sufficient quantity of the emulsion of white mustard seed, leave all to macerate, for from four-and-twenty to six-and-thirty hours, add the alcohol, and continue the maceration for some time, and then distil in the water bath. In this manner we obtain an alcoholic tincture, with a characteristic smell, and which turns white when added to water, like all the solutions of volatile oils in alcohol.

CONCLUSIONS.

It results, from the facts and experiments contained in this memoir—

1. That by submitting dry antiscorbutic plants to distillation with water, but without any previous maceration in cold water, we merely obtain hydrolates of a faint smell, and almost tasteless.

2. The same plants, recently dried, and macerated in cold water, before distillation, produce milky hydrolates of a pungent odour, and exactly resembling those obtained from recent plants.

3. That, after being dried for several months, the radish and the scurvy grass, alone, without having completely lost the faculty of yielding volatile oil by contact with cold water, appear, nevertheless, to possess this property in a smaller degree; but that this faculty may be easily restored to them by means of the myrosyne of white mustard.

4. That if we add an emulsion of white mustard seed to an infusion of radish, and scurvy grass, made in hot water, but afterwards allowed to cool; we soon perceive the sharp and pungent smell become developed in the liquid, the odour of which is due to the essential oil, which can be obtained by distillation.

5. That alcohol prevents the development of the essential oil, in dry antiscorbutic plants, apparently, because this liquid is not able to dissolve the albumen (myrosyne) naturally contained in these plants, and coagulated by desiccation, the albumen not being able to react, except when in solution, on the other principle, also naturally contained in antiscorbutic plants, so as to enable the essence to be formed.

6. That the alcohol which in antiscorbutic plants dissolves the principle that communicates to them the faculty of yielding essential oil, by contact with myrosyne, is, nevertheless, less capable of dissolving this principle than water.

7. That white mustard seed is not the only substance containing the principle (myrosyne of M. Bussy), which is able to extract volatile oils from odorous infusions of radish, scurvy grass, and water-cress, because we have met with this property in the seeds of many other plants of the same family of cruciferæ. We are even more inclined to believe that this myrosyne exists in the seeds of all cruciferous plants, from having discovered it in all those we have examined.

8. That strong acids, caustic alkalies, alkaline carbonates, and metallic salts, prevent the formation of the essence in dry antiscorbutic plants in contact with water, exactly in the same manner, as they prevent the formation of the essence in black mustard, placed under the same conditions.

9. That, although all the facts related above may have been such as to induce us strongly to suspect the existence of *myronate* (myronate of potash or lime), in the vegetables in question, the experiments we made, for the purpose of extracting this salt from the radish, proved, clearly, at least in our opinion, that it does not exist. In fact, if it had been there, although we were not able to obtain it in a crystallised state, should we not have discovered it in the glutinous matter precipitated from the liquid A, by means of alcohol at 90°, because M. Bussy discovered that it was insoluble in alcohol?

Would it not also have formed a portion of the extract, prepared with the liquid, B, whose glutinous matter had been separated by hydrate of lead? Most certainly, neither the solution of this extract in water, nor that of the glutinous substance in the same vehicle, developed the essence by their contact with myrosyne. We cannot, therefore, at present, ascertain the nature of the substance which, in antiscorbutic plants, occasions the formation of the volatile oil under the simultaneous influence of water and myrosyne; for, although we have observed that our liquids, A and B, exhibited a slight acid reaction, we cannot imagine that we ought to attribute this reaction to the presence of free myronic acid. Besides the solution of our dry extract, which, also, had an acid character, did not, any more, yield an essence with myrosyne.

10. Finally, we can, in case of necessity, prepare medicaments with dry antiscorbutic plants, which form their basis in a recent state, but that their substitution in laboratories for those obtained according to the formula of the Pharmacopœia, ought, nevertheless, not to be made without special directions.

Since this work has been concluded, we have had an opportunity of obtaining the fruits of various cruciferous plants, and, as we previously assumed from induction, we have been able to prove the presence of myrosyne in them; the fruits, on which we have experimented, are those of the following plants:—

Erysimum	barbarea
,,	cheiranthoides
,,	officinale
Lepidium	sativum
,,	latifolium
,,	ruderale.

To complete this short treatise, we have next to isolate the principle which, in the radish, gives birth to the essential oil under the simultaneous influence of water and myrosyne. Most assuredly the knowledge of the nature of this curious substance, appears to be too interesting, not to give us a lively desire, again to consecrate a few moments of our leisure to its research; may the new experiments, to which we shall devote ourselves, be crowned with success.

VIENNA PASTE IN TOOTH-ACHE.

A LONDON dentist, in a letter addressed to the editor of the *Lancet* observes:—It may not be without interest to the medical profession generally, more especially to those gentlemen who practise in the country, to know that very great relief may be afforded in attacks of tooth-ache, by the application of anhydrous lime and caustic potass, commonly called *pâte de Vienne*. I have used it for a considerable period of time, and with almost uniform success.

The method I generally adopt for its application, consists in making a thick paste of the above powder, by means of pure alcohol. I then take a sufficient quantity, in the shape of a small pill, on the end of a silver probe, and introduce it into the cavity of the teeth, which should previously be well dried.

After remaining in contact with the carious portion of the tooth for three or four minutes, the paste may be removed, and the mouth well rinsed with tepid water; after which, fill the cavity with fine cotton.

Great care is requisite to guard against any portion of the paste falling into the mouth, or upon the fauces, the effect of which would be instantly to create a painful slough.

The editor of the *Lancet* says—"A correspondent at Leeds remarks, that, having seen anhydrous phospheric acid and pure lime advertised as a new cement for stopping decayed teeth, in order to test the efficacy of the remedy, he obtained an ounce of the former and two ounces of the latter. He states that he has tried these agents, over and over again, on members of his family, and also obtained the assistance of a scientific chemist of this town, but both have 'come to a conclusion, that the above remedy is nothing but an article of a cheat, and very dangerous to the patient;' and, being himself a dentist, we will take his dictum on the matter."

HISTORICAL SUMMARY OF PORTUGUESE PHARMACY, FROM THE FOUNDATION OF THE MONARCHY TO THE PRESENT TIME (1845)*

FROM the foundation of the monarchy to the year 1449, a period of 310 years, there is no act of the legislature that makes mention of pharmacy in this country. It is, however, to be presumed that, as diseases must have existed, the profession was followed with more or less method, and consequently with greater or less scientific knowledge. It is assumed that the practice at this time was that of the Arabs, the people whom the Portuguese first conquered. Their pharmacy must have been that of Galen; and the probability of this is greatly

* *Pharmaceutical Journal.*

strengthened by the circumstance of the King, Alfonso V., decreeing the charter of privileges to the apothecary Ananias, on his arrival from Ceuta at the king's request; and extending them to those who accompanied him, to establish themselves in the country—a sufficient proof either that there was neither pharmacy nor Portuguese apothecaries, properly so called; or that, if there were any, they were insufficient.

Subsequently to this period (probably from the kind intentions of the monarch in favour of science and of the health of his people): there appeared, on the 9th of March, 1456, a decree relating to drugs, and other articles in the shops of druggists and others, and imposing fines on those who sold them in an adulterated or deteriorated state. On the 23rd of April, 1461, another decree of the same monarch appeared, with regulations for physicians and surgeons, prohibiting them from preparing medicines in their own houses to the injury of the apothecaries, and with provisions with regard to apothecaries, prohibiting them the practice of medicine and surgery.

It was on the 25th of February, 1521, that the King Don Manoel issued the decree for regulating the office of chief physician of the kingdom thereby created; providing also with regard to foreign physicians, who were prohibited practising in the country without first qualifying themselves therein; and regulating with regard to these qualifications, prohibiting them at the same time taking fees from the sick. It also contains provisions respecting apothecaries; prohibits them opening any (apothecaries') shops without having been examined; and regulates such examinations. Finally, it regulates with regard to visits of inspection, and the prices of medicines. All the monarchs after the King Don Manoel, until the occupation by the Philips, and even in the time of the first of these, in 1591, gave their attention, more or less, to this profession, decreeing regulations and establishing stipends from the revennes of the "Concelhos" to such apothecaries as established themselves in any township; investing them and their professions more and more with various privileges and exemptions, as may be seen in the decrees themselves, which from names and dates may be placed as follows:—

Don Joan III., on the 29th October, 1535; ditto, on 20th August, 1544; ditto, on 5th July, 1554; ditto, on 3rd August of same year; ditto, on 25th June, 1557. Don Sebastian, on 11th November, 1559; ditto, on 16th April, 1561; ditto, on 7th July, same year; ditto, on 16th March, 1563; ditto, on 19th June, 1563; ditto, on 15th March, 1564; ditto, on 27th January, 1565; ditto, on 15th May, 1578; ditto, on 7th June, 15th October, 1575; ditto, on 9th November, 1575; ditto, on 13th October, 1576; ditto, on 10th January, 1578; ditto, on 1st June, 1581. Don Philip, I., on 2nd September, 1581; ditto, 14th January, 1582; ditto, on 18th February, 1583; ditto, on 7th December, 1583; ditto, on 28th May, 1584; ditto, on 5th September, 1584; ditto, on 5th October, 1585; ditto, on 20th December, 1585; ditto, on 18th March, 1588; ditto, on 1st February, 1590; ditto, on 2nd May, 1590; ditto, on 22nd May, 1590; ditto, on 8th April, 1591; ditto, on 2nd August, 1591.

From the occupation of the Philips to the 28th August, 1772, when King Dom José I. decreed the reform of the University of Coimbra, there had been no legislation that we are aware of with regard to this profession. In this reform pharmacy was considered one of the branches of medicine, and as such was included in its preparatory studies. A professor's chair of this science was also instituted, which exists with more or less restriction even to this day. Hence originated apothecaries duly qualified both in the theoretical and practical knowledge of this science, as well as of chemistry; and which they were obliged to study before admission to the Pharmaceutical Dispensary of the University. [For more ample information refer to the Statutes of the University of Coimbra, part I., book iv, cap. 2.]

On the 7th January, 1794, was published the first legal Pharmacopœia, styled the *Pharmacopœia Geral*, from which the principles of pharmacy were to be learned, both by those who devoted themselves to this science in the university (as also to medicine), and by those out of it, that is to say, in private shops, and by which were they examined. From this period to 1835, when was published the *Codiga Pharmaceutico Lusitano* (decreed the legal Pharmacopœia), the former was the guide for students, until superseded by the latter, which even at present is the legal compendium and Pharmacopœia, and will continue to be such until the Faculty of Medicine of the University forms another; this commission having been assigned to it by the decree of 18th September, 1844. In 1836, the two Medico-Chirurgical Schools of Lisbon and Oporto having been reformed, chairs of Pharmacy and Materia Medica were established in them, thereby enlarging the study of this science, from that period, independent of the university. By this same law there was formed another order of apothecaries, who are

permitted to learn the theory and practice of this science, in private shops, provided that, at the expiration of their pupilage, they be found on examination apt in their replies as regards pharmacy, chemistry, and botany.

A circumstance, which, without doubt must greatly influence the advance of this science, if such be the desire of her Majesty's Government, is the formation of an association of apothecaries, for the advancement of pharmacy. It was founded on the 24th July, 1835. Among many representations, all tending to the enlargement of the science, addressed by this association to the Legislative Chambers, as well as to her Majesty's Government, that one stands very conspicuous which asks for the establishment of especial chairs in pharmacy, to be filled by apothecaries properly so called, in the two medico-chirurgical schools previously mentioned.

Such is the state of pharmacy in Portugal (October, 1845); and with regard to the writers on the subject, really national apothecaries (not mentioning some physicians who also wrote thereon), and who are not now living, they are as follows:—Thomé Pores, in 1512; Jesse Homem de Andrade, in 1602; Manoel Gomes Leal, in 1700; Dr. Caetano de St. Antonio, in 1725; Antonio Lopes de Lima, in 1729; Dr. Antonio de Martyres, in 1735; Manoel Rodrigues Coelho, in 1735; Antonio Nogueira Cabral, in 1740; Antonio Martino Bellesa, in 1763; Friar Ivão de Jesus Maria, 1772; Dr. Caetano de St. Antonio in 1763; Friar Christovalho dos Reis, in 1779; Francisco Raemondo Xavier de Costa, in 1794; José Francisco Leal, in 1794; José da Silva Pinheiro, in 1821; Caetano José de Carvalho, in 1833.

There are other writers, but as they are still living, we for that reason do not mention them. We also do not mention the legislative acts on pharmacy from 1794 to 1841. These will be found in the second part of the code of the apothecaries, printed in the city of Oporto the same year.

ON THE GREEN PURGATIVE WATER OF MONTMIRAIL, NEAR VACQUEIRAS.*

BY F. BOUDET.

The fountain that supplies this water was recently discovered in the neighbourhood of the sulphurous waters of Montmirail, whose reputation is of long standing, and the analysis of which was made by Vauquelin in 1818.

The green water is limpid, but it has a slight greenish tinge: its taste is rather bitter, and its temperature nearly 62° F.

Its analysis, for which we are indebted to Professor Blanchet, bears the date of 1843. It gave the following results:—

Green water, 1 litre.

	Gr.
Bicarbonate of lime	0·95
——— soda	2·40
——— magnesia	1·10
Chloride of magnesia	5·50
Sulphate of soda	6·90
Silicic acid	0·07
Organic matters	0·04
Total	16·96

This water, it is said, purges with much greater certainty than Seidlitz water, although it contains only half the quantity of salts. It is also much less disagreeable to the taste, and creates no nausea.

Dr. Cayol, and several other physicians at Paris, are at present studying the medicinal properties of this water. We shall in a future number give the results.

ON GUTTA PERCHA, A PECULIAR VARIETY OF CAOUTCHOUC.*

BY DOUGLAS MACLAGAN, M.D.

Gutta Percha is the Malayan name for a substance which is the concrete juice of a large forest tree, native of the shores of the straits of Malacca, Borneo, and the adjacent countries. The tree yielding it is unknown botanically; all the information we possess regarding it being, that it is a large forest tree, and yields this product abundantly. We are indebted for our knowledge of it to Dr. W. Montgomerie, H.E.I.C.S., whose spirited exertions to improve the cultivation of various articles of colonial produce at Singapore have obtained for him several distinguished marks of approbation from the Royal Society of Arts of London. For his communication regarding gutta percha, Dr. Montgomerie received a silver medal from the Society.

This substance in its crude state differs in many particulars from common caoutchouc; it is of a pale yellowish, or rather dirty white colour; it is nearly as hard as wood, though it readily receives the impression of the nail. It is very tenacious, and not at all elastic.

It seemed to me to be worth while to de-

* *Journal de Pharmacie*, Feb., 1846.

* *Edinburgh Philosophical Journal.*

termine whether or not this substance really was a variety of caoutchouc, and for this purpose I subjected it to the ordinary process of ultimate analysis, and obtained as its per-centage composition—carbon, 86·36; hydrogen, 12·15: the remainder, 1·49, was most probably oxygen absorbed from the air during the process employed for purifying it, as the substance, whilst heating on the vapour-bath, acquired a brown colour. The only analysis of common caoutchouc with which I am acquainted is that of Faraday, who obtained—carbon, 87·2; hydrogen, 12·8. The results are sufficiently near to warrant the conclusion, that the two matters in question are generically the same.

I found also that the gutta percha yields the same product by destructive distillation as the common caoutchouc. Without entering into details, I may briefly state, that both equally yield a clear yellow limpid oil, having no fixed boiling point, and therefore being a mixture of different oleaginous principles. In both instances the distillation proceeds most freely at temperatures between 360° and 398° F., and seems almost stationary at 385°. Comparative analyses of several portions of the two oils were made, and, as is already known of common caoutchouc, the products exhibit a constitution represented by the formula $C^{10} H^8$. The gutta percha thus appears really to be a modification of caoutchouc.

In its general properties it likewise shows a similarity to common caoutchouc. It is soluble in cold naphtha, in caoutchouc oil, and in ether. It is insoluble in alcohol and in water, and floats upon the latter.

Its most remarkable and distinctive peculiarity is the effect of heat upon it. When placed in water at 110° no effect is produced upon it, except that it receives the impression of the nail more readily; but when the temperature is raised to 145° or upwards, it gradually becomes so soft and pliant as to be capable of being moulded into any form, or of being rolled out into long pieces or flat plates. When in the soft state, it possesses all the elasticity of common India-rubber, but it does not retain these properties long; it soon begins again to grow hard, and in a short time, varying according to the temperature and the size of the piece operated on, regains its original hardness and rigidity. A ball 1 inch in diameter was completely softened by boiling water in 10 minutes, and regained its hardness completely in less than half an hour. It appears to be capable of undergoing this alternate softening and hardening any number of times without change of property.

It is also to a certain extent ductile. When soft it is easily torn across, but when hard it is very tenacious. A piece not an eighth of an inch in thickness, when cold, easily raised a weight of 42lb., and only broke when half a hundred weight was attached to it.

From these properties, it seems capable of many applications in the arts. Its solution appears to be as well adapted as that of common caoutchouc for making water-proof cloth; and, whilst softened, it can be made into solid articles, such as knife-handles, door-handles, &c. The Malay employ it for the former of these purposes, and prefer it to wood. A surgeon, furnished with a small piece, could easily, with the aid of a little hot water, supply himself with bougies or pessaries of any size or form.

ON SOME APPARENT ANOMALIES DURING THE DISTILLATION OF MERCURY.*

BY M. CH. BARRESWIL.

In a note laid before the Academy of Sciences at the sitting of the 28th April, 1845, M. Millon noticed the following fact, which appeared to him to be inexplicable, namely, that the addition of certain foreign metals, in so small a quantity as to evade analysis, modifies the progress of the distillation of mercury.

If we examine attentively the experiments of the author, we are struck by the following circumstances, which he appears not to have observed; that the metals which retard the evaporation of mercury, are oxidizable, while gold, an inoxidizable metal, does not possess this property, and we are tempted to form a very simple theory from these phenomena. We are led to admit, in the first instance, that zinc and lead do not possess the influence attributed to them by M. Millon, and that the retardation observed in the distillation, is due to the production of a thin coating of oxide, which covers the surface of the metal, and checks its evaporation; we then, can easily see that a thousandth part, or even a ten thousandth part, would be sufficient, in the case of the distillation of mercury, either pure or alloyed, to produce the most characteristic differences.

We may also convince ourselves, by experiment, that mercury, rendered impure by an oxidizable metal, is covered as soon as we heat it in the air, with a thin coating, formed by the metallic oxide, and very finely divided particles of mercury; the author, also, does not say that he excluded the air from his distilling apparatus. Besides, nothing is

* *Comptes Rendus*, March 9th, 1846.

easier than to convince oneself of the influence of a foreign body to cover the surface of a liquid submitted to evaporation, for this purpose we may imagine a thousand plans. I will rely on the following :—

I carefully placed in an oil-bath two retorts of the same form and size, each containing the same quantity of water. Into one of these retorts, I poured a few drops of oil, sufficient to cover the surface of the water, with a very thin coating ; I then heated the bath until I saw the domes of the retorts were covered with small drops of water, and, at this point I reduced the temperature. At the expiration of two hours, I weighed the water furnished by each of the retorts, and I ascertained that the one containing pure water had given off more distilled water than that containing the small portion of oil.

This fact, and the reasons already mentioned, permit us, I think, to conclude, that in the distillation of impure mercury, the phenomena observed by M. Millon, do not arise from the presence of metals ; and that we cannot see in these experiments, as the author believes, influences that remind us of those of graphite on the iron contained in steel.

Another phenomenon, which, in the first instance, appears extremely singular, but which belongs, as I believe, to the class of well-known facts, is, that while, in consequence of the introduction of lead or zinc into mercury, the evaporation of that metal is retarded, it is accelerated under the influence of platina.

It appears to me, that the platina acts in this case in the same manner, as when in contact with any liquid whatever ; and that for this very simple reason, namely, that, in the case of mercury, as in other liquids, the platina is in a state of suspension, and not solution, so that by simple mechanical operation, by agitating platinized mercury in water, we may remove the platina. This metal, mixed with cold mercury, forms a thick pellicle on the surface of the bath, which can be removed by drying the mercury, and raising it to the boiling point, it can be caused again to re-appear by agitation with water. In other respects, the phenomena presented by platinized mercury, may be also produced by other bodies capable, like platina, of being divided in the mercury. Thus it is, that a trace of chlorine gives to a considerable quantity of this metal the property of attaching itself strongly to glass.

I have said that it is sufficient to agitate the mercury with water to ascertain the presence of platina ; this simple operation may also answer the purpose of discovering the presence of lead in mercury. By means of this simple test, we may discover quantities of lead that would escape all other processes of analysis. It is sufficient to agitate with water the mercury adulterated with lead, for the space of a minute, to cause the lead to become oxidized, and be discovered in the water, under the form of light flocks, which, after repose, collect, and may be easily separated. I may add, that mercury tainted with lead, agitated in the air, is soon covered with a black powder, which is no other than finely-divided mercury, killed by the oxide of lead.

In fine, if I do not deceive myself, the facts mentioned in this note, and even the simple consideration of M. Millon's essay, clearly explain the anomalies presented during the distillation of mercury, and show that these phenomena are nothing extraordinary.

IV. REVIEWS AND NOTICES OF BOOKS, &c.

INSTRUCTIONS FOR MAKING UNFERMENTED BREAD, WITH OBSERVATIONS. By a Physician. London : Taylor and Walton.

The plan laid down by the author of this tract for the production of "unfermented bread," is similar to one proposed by Dr. Thomas Thomson, in the supplement to the fourth, fifth, and sixth editions of the Encyclopædia Britannica. It consists in the generation of carbonic acid, directly, by means of bicarbonate of soda and hydrochloric acid, instead of obtaining it indirectly, and at the expense of the nutritious portions of the flour by the process of fermentation.

Several years since a patent was taken out for a somewhat similar process, but in that instance the carbonic acid was generated by the reaction of sulphuric acid and carbonate of lime, the carbonic acid gas being conveyed to the dough by means of a tube or tubes.

In the work before us the following receipts and directions are given :—

"TO MAKE WHITE BREAD.

Take of flour, dressed or household	3lb. avoirdupois.
Bicarbonate of soda, in powder.....	½ oz. troy.
Hydrochloric acid, S. G. 1·17	5 fluid ounces.
Water	25 fluid ounces.
Salt	½ oz. troy.

"TO MAKE BROWN BREAD.

Take of wheat meal*	3lb. avoirdupois.
Bicarbonate of soda, in powder.....	41½ drachms troy.
Hydrochloric acid, S. G. 1·17.....	5 fluid drachms. 25 minims.
Water	30 fluid ounces.
Salt	½ oz. troy.

"First mix the soda and flour as thoroughly as possible, which is best done by shaking the soda from a small sieve over the flour with one hand, and stirring the flour all the while with the other. In general this will answer sufficiently, but the end will be obtained more certainly if the mixture be passed, afterwards, once or twice through the sieve. Next dissolve the salt in the water, and add the acid to it, taking care to perfect the mixture by stirring them well together. Then mix the whole, intimately, as speedily as possible, using a wooden spoon, or spatula, for the purpose. The dough thus formed will make two loaves, somewhat larger than half-quartern. They should be put into a quick oven without loss of time. This is more conveniently done in long tins; the oven should be made hotter than for common bread. A portable one, where there is no other, and a common fire will answer the purpose. About an hour and a half will be required for the baking."

Whether this plan can be made practically useful in a large way, experiment alone can prove, but on board ship, and in other cases where yeast cannot be procured, the simplicity of the method cannot fail to recommend it to notice, leaving out of the question the more wholesome nature of the bread and the greater economy which it is said are attached to the process. Is it, however, quite certain that, after the introduction of the carbonic acid, the nutritive portions of the flour do not, to a certain extent, undergo the process of fermentation and become decomposed?

Taking it altogether, this little work appears to us to be well-timed, and the observations it contains on the dietetic properties of various kinds of bread, well deserve perusal.

* Flour with the whole of the bran.

MISCELLANEA.

THE BLOOD IN A SNAIL.

M. GASPARD, in the *Journal de Physiologie*, says the blood of the snail of the vine, *Helix pomatia*, deserves our notice, for an instant. It is contained not only in the organs of circulation, but it is also poured out, principally when the animal travels, into the cavity containing the digestive and genital viscera, which float in the blood, so that by cutting through the division that separates the trachea and the abdomen, an abundant and continued jet is seen to issue. When the animal is drawn into its shell and concealed, it is not poured out in the same manner. This phenomenon particularly struck me, and I know of nothing analogous to it in other animals.

Mr. Milne Edwards observed, in the Academy of Sciences at Paris, when this fact was referred to, that the same thing occurred in the case of fishes, and that it was also noticed by Cuvier in the Aplysia, but that neither M. Gaspard nor Cuvier understood the importance of the subject; they looked upon it as a curious anomaly, not seeing its relative bearing on the general theory of the circulation. It is now seen, that the passage of the blood from the vessels into the great cavities in the bodies of the molluscæ, or the return of that fluid in an opposite direction, is not a phenomenon of exhalation and absorption, as they believed; that the interorganic spaces perform the part of vessels for the circulation; and that the pretended exception is, on the contrary, the common rule for the whole of the system of the blood-vessels in the molluscæ, as well as for the group of articulated animals.

ON THE TEMPERATURE OF THE EARTH AND SEA.*

BY MR. A. B. TAYLOR.

At a meeting of the Royal Institution, on the 20th February, Mr. Taylor observed, that the atmosphere is an aërial film surrounding the earth, but, although of almost inappreciable thinness when compared with the earth's diameter, it forms a non-conducting investment, resisting the radiation of terrestrial heat into space. The mean density of the earth, according to Baily, is 5·66, or about twice 2·8, the density of rocks and strata constituting its surface. We infer from hence that the mass of the earth must be formed of materials lighter than the common metals, as iron, tin, lead, &c. Its specific gravity falls between that of tantalum and tellurium.

From careful inquiry it appears that the temperature of the *surface* of this planet depends entirely on heat acquired from the sun. Part of the heat thus received is conducted to a certain depth below the earth's surface, and part radiates into space. The greatest natural cold on the surface was observed by Erman at Yakutsk, the capital of Eastern Siberia, where the thermometer stood at 72° below the zero of Fahrenheit. The temperature of space beyond the limits of the atmosphere must therefore be much colder—too cold to admit of the maintenance of life under its present conditions. The heat of the sun penetrates the earth to but a very small depth. Diurnal variations of temperature are not perceived below two or three feet, while the annual variations do not affect the earth's crust below $\frac{1}{100000}$th of the diameter of this planet. On the alternate heating and cooling of this film of depth depend the vicissitudes of climates, seasons, and cycles of years.

Mr. Taylor then stated, that, at a certain depth below the earth's surface, there is a stratum at which the thermometer is almost stationary. This stratum is consequently termed *the stratum of invariable temperature*. The depth of this stratum depends—1st, on the directness with which the sun's rays fall; and 2nd, on the conducting power of the superficial strata. It must, therefore, be different in different localities. At Paris the depth of this stratum has been accurately ascertained to be 90 feet below the surface, at which depth the temperature has, for fifty years, remained constant at 53° Fahr. In other different parts of the world, this stratum varies in depth from the causes already assigned. The thickness of this stratum in the temperate regions varies from 55 feet to 60 feet below the surface, while in the regions of extreme cold, solar influence does not extend beyond three or four feet, the ground below this depth being found always frozen, to the extent of 400 feet. Generally, however, the temperature of this invariable stratum differs but little from the mean temperature of the place.

Mr. Taylor then directed attention to the important and universal truth, that, when carried below this stratum of invariable temperature, the thermometer rises. This rise is not, however, the same at all depths in all places. As there are *isothermal lines on* the earth's surface, so there are *iso-geothermal lines beneath* it. Many localities, as five of the principal mines in Cornwall, the well of Grenelle, at Paris, the Monkwearmouth mine of Sunderland, Joseph's Well at Cairo, &c., were noticed as indicating the great curvature of the iso-geothermal lines.

The theory of the existence of internal heat was then established from—1, this progressive rise of the thermometer in descending into mines and other excavations; 2, the high temperature of the water of Artesian wells; 3, the high temperature of natural thermal baths or springs; 4, the phenomena of volcanic eruptions and earthquakes.

From accurate examination of these sources of inquiry, it has been found that the thermometer rises in mines one degree for about every fifty feet of depth; a result confirmed by the fact that the temperature of water in Artesian wells increases in about the same proportion to their depth. The heat of thermal springs has been found equal to that of boiling water, and the perfectly fused condition of substances ejected from volcanoes indicates a temperature of 1,000°. The opinions of various philosophers respecting the cause of the central heat of the world were reviewed. Buffon held that the earth was a vitrified ball in the act of cooling; Leslie and Halley that it was a hollow sphere, made up of stories like a house; others, that the interior of the earth is in a perfectly molten state, the heat at twenty miles below the surface being sufficient to melt granite.

Having pointed out the objections to these various hypotheses, Mr. Taylor affirmed, as an apparently certain fact, that this internal heat does not affect the temperature of the earth's surface. He particularly dwelt on a calculation of Arago, that if in the period of 2,000 years the earth had cooled only $\frac{1}{100}$th of a degree, the fact would have been indicated by a difference in the length of the day, in

* *Athenæum*, Feb. 27, 1846.

consequence of that contraction of its diameter, which any diminished temperature of that planet would have occasioned. Mr. Taylor also quoted records which proved that the climate of Tuscany has undergone no change during the last 200 years.

With respect to the temperature of the sea, many difficulties are offered to accurate observation. The uncertainty as to the depth to which thermometers can be sunk, the influence of cold and warm currents, the laws regarding the circulation of heat in liquids, and the effect of heat on the density of water, present serious obstacles to accurate results. The most careful observations and calculations give an oceanic temperature of from 34° to 44°.

It is probable that the submarine strata are sufficiently thick to prevent the free conduction of central heat; while the effects of heat on the density of water, together with its rapid diffusion throughout the mass of the ocean, would render a high temperature imperceptible at any one point. On the other hand, the abundance of insular volcanoes sufficiently testifies the existence of igneous matter beneath. From these considerations, Mr. Taylor concluded—

1. That, at a certain depth below the surface of the earth, there is a source of heat which increases as we descend.

2. That this heat cannot be derived either from the sun or from chemical changes.

3. That this heat neither perceptibly affects climates nor seasons, nor influences the temperature of the surface of the earth, nor the depths of the ocean, nor of the atmosphere.

4. That the vicissitudes of climates and seasons are entirely referable to solar influence.

5. That this influence, even at its maximum, does not penetrate below $\frac{1}{100000}$th of the earth's diameter.

6. That, although we have positive evidence that subterranean heat exists, we can neither measure its intensity, nor determine the exact ratio of its increase towards the centre of the earth.

7. That there is no evidence to show that the earth is gradually cooling from a high temperature.

ROYAL COLLEGE OF CHEMISTRY.

His Royal Highness Prince Albert has subscribed the sum of 100*l.* (in addition to 100*l.* on behalf of the general fund), and Richard Blakemore, Esq., M.P., 500*l.* to the Royal College of Chemistry, to enlarge the present establishment.

THE MEANS EMPLOYED FOR OBTAINING DOUBLE FLOWERS.

How many erroneous circumstances up to this day have been admitted to explain the cause of doubleness in certain flowers! Thus, for example, many gardeners pretend, that to obtain double Brompton stocks, you must gather the seeds exclusively from those flowers which are the most double. What influence can these flowers have when certainly deprived of all the organs of generation? None whatever. To explain this phenomenon, we must make practice agree with theory. Every gardener who sows seed, wishes to obtain plants with double flowers, so as to obtain blossoms which produce the greatest effect. Every double plant is a monstrous vegetable. To produce this anomaly, we must attack the principle of its creation, that is to say, the seed. This being granted, let us examine in what way these seeds ought to be treated. If, after having gathered the seeds of Malcomia annua, or ten-weeks' stock, we sow them immediately afterwards, the greatest number of the seedlings will produce single flowers, whilst on the contrary, if we preserve these same seeds for three or four years, and then sow them, we shall find double flowers upon nearly all the plants. To explain this phenomenon, we say that in keeping a seed for several years, we fatigue it and weaken it. Then, when we place it in a suitable soil, we change its natural state, and from a wild plant make it a cultivated one. What proves our position is, that plants, in their wild state, shedding their seeds naturally, and sowing them as soon as they fall to the ground, yet in a long succession of time scarcely ever produce plants with double flowers. We think, then, after what we have said, that whenever a gardener wishes to obtain double flowers, he ought not to sow the seeds till after having kept them for as long a time as possible. This practice ought to be observed with all plants that we wish should produce double flowers, for all varieties of the Brompton stocks, pinks, &c. As to Brompton stocks, ten-weeks' stocks, and others of the same kind, there is no doubt that to flower them well they should be sown in autumn in well-worked soil, taken up when the cold weather comes, and kept under a frame during the winter. In the spring they may be planted out again, when they will flower magnificently, and yield an abundant harvest of seeds. If you have not a frame at your disposal, you may obtain the same result by sowing the seeds, at the end of February, under a south wall, for example. The prin-

ciples that we admitted above, are just as applicable to melons and all plants of that family. We admit, like many other observers, that melon plants obtained from seeds the preceding year, ought to produce, and do produce, really very vigorous shoots with much foliage; but very few fruitful flowers appear on such plants, whilst, on the other hand, when we sow old seeds, we obtain an abundance of very large fruit. In fact, in all varieties of the melon the seeds should always be kept from three to eight years before being sown, if we would obtain fine fruit and plenty of it.

ON THE OCCUPATIONS OF THOSE WHO ARE MOST EXPOSED TO METALLIC COLIC. (COLICA PICTORUM.)*

BY M. CHEVALLIER.

Authors, it is well known, differ considerably from each other respecting the occupations or trades which render men most liable to attacks of colic. Out of 1,360 cases received into the Parisian hospitals, during a period of five years, from 1838 to 1842, M. Chevallier constructed the following table, respecting the relative liability of workmen of different trades:—

Workers in white lead	841
Painters	310
Type manufacturers	33
Colour preparers	29
Workers in metals	22
Pottery manufacturers	11
Casters	6
Gilders	4
Polishers	4
Glassmakers	3
Varnishers	2
Jewellers	2
Enamellers	2
Chasers	1
Turners	1
Chemical manufacturers	1
Lapidaries	1

Among 57 journeymen the occupations were not ascertained. In addition to the above, weavers are subject to lead colic, from the circumstance, that they are compelled to handle the leaden cylinders which are used for stretching the threads.

The table shows, that white lead workers are most exposed to this disease. The 841 cases came from six factories, in the short period of only five years, and of these, 55 proved fatal. It is impossible to institute a fair comparison with respect to other occupations, since the number of workers thus employed is unknown. It will be observed that the workers in metals, chiefly of copper and its alloys, or of lead in the metallic state, are but little subject to metallic colic. In fact, during a period of five years, only 22 were received into the Parisian hospitals, although the number of workmen employed in this occupation is very large. It will be perceived, that the workers in other trades are very little subject to the disease.

* *Gazette Médicale*, Jan. 17, 1846.

MADEMOISELLE COTTIN.

The wonderful performance of the electrical girl has been proved to have been a clumsy piece of jugglery; and it is astonishing how M. Arago and other members of the Academy could have been so much deceived as to introduce the subject to notice in the manner they did.

PYROPHORUS FROM TARTAR-EMETIC.

A very dangerous pyrophorus may be produced by igniting tartar-emetic in a closed crucible. In some experiments to prepare pure antimony in Prof. Wackenroder's laboratory, several ounces of tartar-emetic were submitted to a slight calcination. On emptying the carbonaceous residue, which was still somewhat warm, from the crucible into the dish, it took fire in a few minutes, probably from being breathed upon, and was then suddenly projected about the laboratory, forming a shower of fire.

CASE OF POISONING BY SMALL AND REPEATED DOSES OF ACETATE OF LEAD.

BY H. LETHEBY, M.B.

Matthew Muir, aged six years, was attacked about nine weeks ago with hooping cough. His mother, in her gossip with the neighbours, heard about the wonderful efficacy of a medicine sold by a schoolmaster, who lived in the Kingsland-road. She consequently sent there, and procured a bottle of it, the instructions being, that the child should have a teaspoonful whenever the cough was troublesome, but she only gave it two or three times a-day.

Upon examination, the mixture was found to consist of ten grains of acetate of lead dissolved in six ounces of water, so that the

child had been taking one-fifth of a grain of sugar of lead two or three times a-day, for nearly nine weeks. About this time it got worse, and Dr. G. A. Rees was sent for. This gentleman instantly recognised the symptoms of poisoning by lead, and, after searching into its source, he traced it to the medicine, and advised its discontinuance. Two days after this the child died, and, at the instance of the coroner, we were called upon to make a further inquiry into the case.

It was learned from the parents, that the child was a fine healthy boy before this sickness, but that, almost immediately after it had commenced taking the schoolmaster's medicine it began to fall away, and to complain of severe pains in its belly; these were proved to be of a colicy nature, by the fact, that the child always lay upon its abdomen when it sought relief or went to sleep; its belly also became hard, and rather pinched in; the bowels were very confined, and the stools black and disagreeable, there was also a most intolerable foetor of the breath; latterly the child got very drowsy, and was unable to move about as usual; in short, the limbs were beginning to get palsied. Upon the day of its death, however, it became convulsed, and a few hours before death, fell into a state of coma, from which it was never roused.

RISING OF LAND.*

It is a fact, worthy perhaps of a passing notice, that the whole of the land in and about the neighbourhood of Conception Bay, Newfoundland,—very probably the whole island is rising out of the ocean, at a rate which promises, at no very distant day, materially to affect, if not render useless, many of the best harbours we have now on the coast. At Port-de-Grave a series of observations has been made, which undeniably prove the rapid displacement of the sea level in that vicinity. Several large flat rocks, over which schooners might pass some thirty or forty years ago with the greatest facility, are now approaching the surface, the water being scarcely navigable for a skiff. At a place called the Cosh, at the head of Bay Roberts, upwards of a mile from the sea shore, and at several feet above the level, covered with five or six feet of vegetable mould there is a perfect beach—the stones being of a moderate size, and in all respects similar to those now found in the adjacent land-washes.

* *Newfoundland Times.*

INDIAN COBALT.

A NEW field of cobalt has been discovered in the East Indies, in the mountainous country of Rajpootanah—a district already celebrated for its mineral wealth, and principally for its rich and various copper ores and its alums. It is in one of the copper-mines that this cobalt is found—lying abundantly in the state of sulphate of great purity. It is accompanied by only one other substance—pyrites of iron, highly magnetic, and easily separated from it by a loadstone of moderate power. These it contains in the proportion of 9·22 per cent. The remainder of the mineral consists wholly of pyrites of cobalt, of the specific weight of 5·45 and the composition following:—cobalt 64·64, sulphur 35·36. The Indian jewellers already use it advantageously for colouring gold, with a rose tint of great delicacy.

NEW CEMENT FOR THE TEETH.

M. OSTERMAYER proposes a cement which he considers to approach very nearly to the composition of enamel: it consists of quicklime, 13 parts; anhydrous phosphoric acid, 12 parts. The lime must be finely pulverized, and chemically pure. The anhydrous phosphoric acid is obtained by the combustion of phosphorus in dry air. The two substances are to be quickly mixed together, so as to form a powder. This is to be introduced into the cavity of the tooth, previously dried, and to be moistened with a small quantity of water.

TO CORRESPONDENTS.

"J. S.," a Subscriber, (Liverpool)—will find his question resolved at page 175 of the present number.

"W. MASON."—Our correspondent's communication came too late to be attended to in this present number, but he shall be answered in our next.

We have received "Ranking's Half-yearly Abstract of the Medical Sciences," vols. 1 and 2, which shall be noticed in our next.

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 310, Strand, London." *Communications must be prepaid, and sent before the* 15*th of each month; Books for Review before the* 10*th.*

THE CHEMIST.

I. CHEMISTRY.

EXPERIMENTS ON THE COMBINATIONS OF MELLON.*

BY MESSRS. M. M. A. LAURENT AND CH. GERHARDT.

In consequence of the animadversions of M. Liebig on the chemical researches of Messrs. Laurent and Gerhardt, the latter chemists undertook the following experiments, the result of which they laid before the Academy of Sciences.

The comparative study of the changes organic substances undergo, by means of chemical agents, suggested to us, lately, several new ideas on the chemical equivalents of these substances, and also on certain relations that exist between the equivalents of the elements of which they are composed.

We were thus led to establish the principle, that in a regular and precise notation, corresponding with four volumes of vapour—

1. The equivalent of every oxigenated substance, gave an even number, for the oxygen and its substitutes—sulphur, selenium and tellurium.

2. The equivalent of every non-nitrated substance gave a number divisable by four, as the sum of the hydrogen and its substitutes—halogenated substances and metal.

3. The equivalent of every nitrated, phosphorated, or arseniated substance, gave a number, also, divisable by four, as the sum of the hydrogen and nitrogen, or their substitutes.

4. The equivalent of every carbonated substance, always contains an even number of the equivalents of carbon, or is divisable by four, with C=37·5.

In a notation corresponding with two volumes, the preceding values are divided by two.

On account of the simplicity of the formula, we give the preference to this second mode of notation.

Since these propositions were laid down, they have been confirmed by the composition of all well studied bodies; there were but a small number of substances, and those ill understood, and badly analysed, the composition of which did not agree with these views; many exceptions of this kind have also disappeared, since the analyses of several of the substances have been carefully repeated.

Up to the present time, we have been alone in supporting our opinion, not that it has been attacked by means of experiments. We confidently say, no chemist has, as yet, established a single well-proved fact, contrary to the preceding propositions.

We now ask for the judgment of the Academy. The new experiments we are about to lay before it will enable it to decide between M. Liebig and ourselves.

The question in dispute between us reduces itself to the following points:—Either our four propositions are untrue, or M. Liebig's experiments on mellon, sulphocyanogen, and their derivatives, are false.

It must be observed that M. Liebig's experiments on mellon and sulphocyanogen, form one of the principal supports of the theory of compound radicals, taught by that chemist at Giessen. The history of mellon is noticed in M. Gay-Lussac's celebrated work on cyanogen; like that gas, mellon, according to M. Liebig, is a radical composed of carbon and nitrogen, the mellonides correspond with the cyanides, and hydromellonic acid with hydrocyanic acid. It is the same with the radical, sulphocyanogen.

At the time we made our last communication we had not repeated all the experiments of M. Liebig. We had only modified a part of the theory, and the authority M. Liebig's name bore, appeared sufficiently to warrant the correctness of the other results. But now we regret that we must inform the Academy, that this confidence has entirely deceived us, it is not only a portion of M. Liebig's researches that is false, but the whole history of mellon and sulphocyanogen, all their transformations, and all their reactions. More than this, we are enabled to prove that the pretended analogues of cyanogen—mellon and sulphocyanogen—do not exist.

* *Comptes Rendus*, March 16, 1846.

Thus the base of his theories falls to pieces, theories that for ten years have exercised the most baneful influence on science, by inducing a majority of chemists to seek these imaginary compounds.

MELLON.

In the dry distillation of the yellow substance, called, improperly, sulphocyanogen, we obtain a grayish-yellow residuum, which constitutes mellon.

The same product is also formed by the action of heat on melam, ammeline, ammelid, chlorocyanamide, and persulphohydrocyanic acid.

When we employ sulphuretted bodies to prepare the mellon, it is difficult to obtain it perfectly pure; but, it is not the same when we prepare it by calcining chlorocyanamide and ammelid. Our analyses, made upon the products obtained by these processes, gave us, exactly, the formula $C^6 H^3 N^9$.

M. Liebig does not admit the presence of hydrogen in this compound; he only discovered eight atoms of nitrogen, instead of nine; and he also supposed that, under the influence of heat, mellon was transformed, purely, and simply, into three volumes of cyanogen, and one volume of nitrogen. In this there is a serious error, to which we shall recur presently.

Let us now see whether the composition we assign to mellon agrees with that of the bodies from which it is derived, and with its transformations.

FORMATION OF MELLON BY CHLOROCYANAMIDE.

Chlorocyanamide is a body easily obtained in a pure state, by allowing ammonia to act upon the solid chloride of cyanogen, M. Liebig assigned to it the following formula:—

$$C^6 H^3 Cl N^{10}$$

This formula, not agreeing with the propositions we have laid down above, we made a new analysis of chlorocyanamide, and we discovered that M. Liebig had made a very serious mistake. In fact, this compound contains two atoms of chlorine instead of one, its formula is therefore—

$$C^6 H^3 Cl^2 N^{10}*$$

This composition shows, at the same time, the little value we ought to place on the hypotheses of M. Liebig, deduced from his formula. In fact, this chemist considers chlorocyanamide to be a combination of cyanamide, an imaginary body, and protochloride of cyanogen, another imaginary body. These hypotheses necessarily fail in the face of the composition we have just given.

When we heat chlorocyanamide, according to M. Liebig, it sublimes a white substance, containing the whole of the chlorine and chlorocyanamide, and the mellon remains. If the reaction takes place, as M. Liebig says it does, the formula we attribute to mellon, is evidently incorrect. We have repeated this experiment, and we have seen with surprise that the chlorocyanamide is transformed, not only into mellon and sal ammoniac, but that an enormous quantity of hydrochloric acid is also disengaged; about 16 per cent, or one equivalent.

If we deduct from the elements of the chlorocyanamide, the elements of one equivalent of sal ammoniac, and one equivalent of hydrochloric acid, the remainder exactly represents the composition we have attributed to mellon; the following equations show the formation and decomposition of chlorocyanamide:—

CHL. SOL. OF CYAN.

$$2\,C^3 N^3 Cl^3 + H^3 N = C^6 H^3 N^{10} Cl^3 + 4\,C\,H.$$

MELLON.

$$C^6 H^3 N^{10} Cl^3 = C^6 N^9 H^3 + H Cl + H\,Cl\,H^4 N.$$

FORMATION OF MELLON BY AMMELID.

According to M. Liebig, ammelid should have for its formula $C^6 H^9 N^9 O^3$.

This composition not agreeing with our views, one of us thought, more than two years since, it ought to be replaced by the following:—$C^3 H^4 N^4 O^2$.

This correction was afterwards justified in a very remarkable manner, it was admitted by M. Liebig himself, without any doubt on his part.

M. Liebig, in fact, has just published, in concert with M. Wöhler, the announcement of a new derivative of urea, to which he assigns precisely the formula we have proposed for ammelid.

These properties, and the composition of this new body immediately struck us, since they appeared to be applicable to a body already known—ammelid. We therefore repeated the experiments of the German chemists, and we can affirm that the pretended new body of Messrs. Wöhler and Liebig, is no other than ammelid.* We

* M. Liebig cannot again attributed this mistake to an error of the press, for the admission of a protochoride of cyanogen in the chlorocyanamide is founded on his formula. Besides, the quantity of hydrogen he discovered corresponds to nine and a half atoms of hydrogen.

* By the side of the announcement of this new body, is found another, in the same number, of a new cyanic ether; but the formation, the properties, and composition of this new body, evidently proves that this pretended new ether is only the urethane of

have analysed it, as well as the ammelidate of silver, and our experiments have led us to the following formula :—$C^3\ H^4\ N^4\ O^2$.

We have seen that, by calcining ammelid, cyanuric acid, cyanic acid, and ammonia, were disengaged; while mellon remained: there remains the elements of one equivalent of mellon which agrees with the formula, we attribute to it $6\ (C^3\ H^4\ NO^2) = 3\ (C^3\ N^3\ H^3\ O^3 + CHNO + H^3\ N) + C^6\ N^9\ H^3$.

FORMATION OF MELLON BY POLIENE.

The result of M. Voelkel's experiments is, that the melam of M. Liebig is an impure substance, as one of us had already announced, and is composed of a mixture of melam and a substance isomerous with melamine and poliene containing $C^3\ H^6\ N^6$. Melam has not, therefore, the composition attributed to it by M. Liebig.

Again, poliene, subjected to the action of heat, disengages ammonia, and leaves mellon: this decomposition, therefore, again confirms the formula we give to mellon—

$$2\ C^3\ H^6\ N^6 = C^6\ H^3\ N^9 + 3\ H^3\ N.$$

FORMATION OF MELLON BY PERSULPHOHYDROCYANIC ACID.

According to M. Liebig, persulphohydrocyanic acid, subjected to the action of heat, is completely decomposed into sulphuret of carbon, sulphuretted hydrogen, sulphur, and a residuum of mellon, from which potash extracts, without the aid of heat, hydromellonic acid, while with heat, it yields mellonate of potassium, or a new salt, containing no hydrogen.

We completely disagree with M. Liebig. By the calcination of persulphohydrocyanic acid, sulphuretted hydrogen, sulphohydrocyanic acid, hydrosulphate of ammonia, sulphur, yellow crystals, Zeize salt, and an enormous quantity of ammonia, whose presence entirely escaped the attention of M. Liebig, are disengaged. In addition to this, the matter dissolved in the potash, without heat, is not hydromellonic acid, but a mixture of sulphur and ammelid. It is the gelatinous appearance of the precipitate that led M. Liebig into error.

Finally, boiling potash does not convert the residue into mellonide and a new salt, free from hydrogen. This new salt is tribasic; it contains hydrogen, and its acid is of exactly the same composition as that we have attributed to hydromellonic acid in our last communication. It is that assumed by one of us, after the indications of M. Liebig for hydromellonic acid. If we have committed an error, it must be entirely attributed to the numerous contradictions and mistakes to be found in M. Liebig's memoir on this subject.

We will return to these compound bodies in another memoir.

Finally, the residuum of the calcination of persulphohydrocyanic acid, or mellon, gives no trace of hydromellonic acid, when treated with potash.

The preparation of mellon, by the calcination of persulphohydrocyanic acid, is easily understood, for it is preceded by that of poliene, and it is the latter which is converted, as we have seen, into mellon and ammonia.

THE ACTION OF HEAT ON MELLON.

M. Liebig has said, and repeated it many times, that mellon is decomposed by the action of heat, into three volumes of cyanogen and one of nitrogen. If mellon has the composition we attribute to it, such a decomposition is impossible.

We have repeated M. Liebig's experiments, with pure mellon, arising from the chlorocyanamide, and we have seen, that, besides the cyanogen and nitrogen, whose proportions vary considerably, at the beginning and at the close of the operation, a gas is disengaged absorbable by hydrochloric acid, while two different substances are sublimed, one of a reddish colour and the other yellow.

We could scarcely comprehend, how a decomposition so complicated only exhibited, in the hands of M. Liebig, three volumes of cyanogen and one volume of nitrogen; but his theory required it to be so.

ACTION OF POTASH ON MELLON.

M. Liebig, when examining the action of potash or mellon, perceived that a new salt was formed, to which he attributed the following composition :—$C^4\ N^6\ Ag^2\ O$, salt of silver.

Our experiments on this subject being not yet concluded, we shall, at present, confine ourselves to saying, that the formula of this salt is entirely different, and that it is impossible that such a body should be produced under the influence of potash, if the formula of mellon is such as we have attributed to it. We will return to this compound in another memoir.

ACTION OF POTASSIUM ON MELLON.

M. Liebig's theory appeared to be solidly based, by the fact of the direct combination of his mellon with metallic potassium, but

M. Dumas. We propose to publish a note upon this subject, as soon as we learn that M. Wurtz acknowledges the identity of the two substances.

his theory prevented M. Liebig seeing correctly. If we take very pure mellon, arising from the calcination of chlorocyanamide, heat it with a morsel of potassium cut round with a penknife, so as to have it free from naphtha, the combination will be immediately effected, with the disengagement of light, but, at the same time, a large amount of ammonia will be also disengaged.

This disengagement of ammonia did not entirely escape M. Liebig's notice; but he attributed it—who would have thought it?—to the naphtha adhering to the potassium

We will return, in another memoir, to the composition of the mellonurets.

Here is another fact which we hand over to chemists for their appreciation. When we add an acid to a mellonuret, it produces a white precipitate, which M. Liebig described at length, some time since, under the name of hydromellonic acid. One of us, while operating on this product, perceived that it contained large quantities of potash, and we acquainted M. Hoffman, M. Liebig's nephew, with the fact; we know not whether this letter was communicated to M. Liebig, we are willing to believe that the communication was never made to him; but since we pointed out the presence of potash in hydromellonic acid, M. Liebig suddenly changed his opinion. The companion to hydrocyanic acid, hydromellonic acid, no longer exists, according to him; the body he analysed and described under that name, is now only an acid mellonuret of potash leaving, by calcination, 17 per cent. of the cyanide of that metal.* M. Liebig relies on this fact to accuse us of bad faith, by pretending we never made the experiments, we communicated to the Academy.

ACTION OF SULPHURIC ACID ON MELLON.

We shall say but one word on this subject, intending to return to it at a future time. According to M. Liebig, mellon is dissolved in sulphuric acid, and when water is poured into the solution, the mellon is precipitated, without having undergone any change. We can affirm that the body precipitated under these circumstances differs completely from mellon, and that the liquid contains sulphate of ammonia.

PREPARATION OF MELLON WITH SULPHOCYANOGEN.

Mellon can be obtained, according to M. Liebig, by calcining the radical of the sulphocyanurets, that is, sulphocyanogen.

We know that M. Liebig considers the latter as a simple compound of cyanogen and sulphur, his theories required this. But the correctness of M. Liebig's analysis had been already contested by Messrs. Parnell and Voelkel, who assert that sulphocyanogen contains in addition, oxygen, and more than a hundreth part of hydrogen. The formula proposed by Messrs. Liebig, Voelkel, and Parnell, appeared to us inadmissible, and we have studied the subject anew.

After having passed a current of chlorine through sulphocyanuret of potassium, we examined the yellow precipitate with a microscope; but what was our astonishment at seeing that this precipitate was a mixture of three different substances, and yet it is on such a mixture that M. Liebig has founded the theories of sulphocyanurets.

To obtain pure sulphocyanogen, we had to pass a current of chlorine through sulphocyanuret of potassium. We stopped the operation from time to time and filtered; then we examined with the microscope, successively, all the precipitates, and we analysed that which appeared to us to be most homogeneous.

The substance, after having been long and well dried, was quickly weighed to give it no opportunity of absorbing moisture, we obtained by analysis, results which are well represented by the following formula:—

$$C^3 N^3 S^3 H.$$

We have, therefore, along with the sulphohydrocyanic acid—

$$3CNSH + Cl^2 = C^3 N^3 S^3 H + 2 H Cl.$$

As to the formation of mellon by the calcination of the so called radical, of the sulphocyanurets, it is easily understood. We know that in this operation sulphur or sulphuret of carbon—are disengaged while mellon remains, we have therefore.

$$3C^3 N^3 S^3 H = C^6 H^3 N^2 + 3CS^2 + S^3.$$

CONCLUSIONS.

To sum up this discussion, we should say—

1. Mellon is not as M. Liebig says, a binary compound, that may be compared with cyanogen; for besides the carbon and nitrogen, which do not exist in the proportions mentioned by M. Liebig, it contains a half per cent. of hydrogen and is represented by

$$C^6 H^3 N^9.$$

2. Mellon does not combine purely and simply, as M. Liebig says, but the combination is accompanied by the disengagement of ammonia, and the product forms a bibasic salt $C^6 N^8 M^2$; a salt, which, when dissolved in water gives, perhaps, $C^6 N^8 M^2 H^2 O$.

3. Mellon arising from the calcination of per sulphohydrocyanic acid, when dissolved in potash, does not yield a mellonuret as M. Liebig has advanced, but produces a tribasic

* We have long known that the neutral salt of potassium yields an acid mellonide. M. Gmelin noticed the presence of a small quantity of potash in hydromellonic acid.

salt $C^6 HM^3 N^8 O^2$, containing hydrogen and oxygen, and, at the same time, giving out ammonia.

The so-called sulphocyanogen of M. Liebig does not only contain sulphur, carbon, and nitrogen, but also hydrogen; it is not, therefore, the radical of the sulphocyanurets.

5. The composition attributed, by M. Liebig, to melam, is incorrect, this body being a compound of poliene and mellon.

6. The substance that dissolves without the aid of heat, when treating the mellon arising from the calcination of persulphohydrocyanic acid, is not, as M. Liebig says, hydromellonic acid, but ammelid.

7. The composition assigned by M. Liebig to chlorocyanamide is incorrect, its true formula being $C^6 H^8 Cl^2 N^{10}$.

8. Chlorocyanamide is not decomposed by the influence of heat, into sal-ammoniac and mellon, as M. Liebig says, for it disengages, in addition, 1 equivalent of hydrochloric acid.

9. The new substance announced, in the last instance, by M. Liebig, as formed by urea, is a substance already known under the name of ammelid.

10. Ammelid has not the composition attributed to it by M. Liebig, the formula formerly proposed by M. Gerhardt is correct.

11. The cyanic ether of M. Liebig is merely urethrane.

12. M. Liebig's theory on mellonic combination, is completely wrong, and our four propositions, noticed above, are proved, by facts, to be as we have rectified them.

ON THE ACTION OF SUGAR ON TARTARIC ACID.*

BY M. VOGEL JUN.

It is a well ascertained fact, that sugar and tartaric acid, when exposed to air that is not too moist, undergo no sensible change; they attract a very small portion of moisture.

But it is very different when we expose a mixture of these two substances to the air. While the same mixture, protected from the access of air in a well closed bottle, undergoes no appreciable change, enclosed in a pasteboard box, which does not completely prevent the access of air, it loses, in a short time, its pulverable properties, and passes into the state of a viscous mass. When it has undergone this change, it is no longer possible to obtain crystals of sugar or tartaric acid, from its aqueous solution. These two substances appear to have undergone a mutual decomposition by their mixture, when in contact with air, I have made several experiments to elucidate this subject.

A mixture of one part tartaric acid, and three parts of sugar, was exposed to the air in a porcelain capsule; after a few days exposure, the mixture had lost its pulverable condition, and its weight increased daily, some hundredths. The powder assumed, in succession, the appearance of a viscous mass, which was transformed into a transparent liquid, containing in solution the two substances that formed the mixture.

The mixture, exposed to the air for two months, was no longer viscous, but it had become as liquid as syrup of sugar not much concentrated. This deliquescence of the mixture takes place more rapidly when it is placed in a shallow plate in a cellar, and, more particularly, when it is composed of equal parts of sugar and tartaric acid. Even, after 24 hours, the powder, where it had been thinly spread, was changed into a perfectly transparent solution.

Sugar and tartaric acid, separately exposed, under the same circumstances, to the air of a cellar, also, it is true, attracted moisture, but in a much less degree, and much less rapidly than when mixed together, from whence it follows, that the tendency of these two substances to attract the humidity of the atmosphere, is augmented by their mutual contact.

Wishing to ascertain the quantity of water the mixture absorbed, to enable it to become completely fluid, I exposed a mixture of one part of sugar and two parts of tartaric acid to the air, in a cellar, in a large porcelain vessel, previously weighed. After it had become completely liquid, the solution formed by a mixture of two ounces of sugar and one ounce of tartaric acid, weighed four ounces and six drachms; the mixture had, therefore, absorbed one ounce six drachms of water, to become liquid.

As I have already observed, it is impossible to extract the sugar or the tartaric acid from the solution, in a crystallised state, because, when it is evaporated to dryness, it again rapidly absorbs the atmospheric air. The dry mass is completely soluble in pure alcohol, but neither the sugar nor the tartaric acid can be separated from the alcoholic solution in a crystallised state.

The following experiment clearly shows, that the tartaric acid has undergone a change by its contact with sugar. When we add lime water to the mixture, after it has been liquified in the air, so as perfectly to neutralise the acid, only a very small quantity of tartrate of lime is precipitated, and the filtered liquid contains a large quantity of the salt of lime in solution. The acid appears, therefore, to have undergone, by its contact with the sugar, one of these modi-

* *Journal de Pharmacie*, March.

fications discovered by M. Frémy, and to have been converted into tartralic acid. This supposition is confirmed by the following fact. The liquid, when neutralised by lime-water, acquires an acid reaction, when we add to it oxalic acid, in sufficient quantity to precipitate the whole of the lime.

To be satisfied that the tartaric acid is changed by its mixture with sugar, into tartralic acid, it is necessary to separate these two substances from the liquified mixture, we may succeed in this by the addition of carbonate of barytes to the liquified mass, until it is perfectly neutral, and without raising the temperature. In this case, a portion of it is changed into tartrate of barytes, which, being insoluble in water, remains upon the filter, and the filtrated liquid contains the sugar, with the salt of barytes, which is soluble in water; when we add alcohol to this solution, a precipitate is formed, completely soluble in a small quantity of water, this watery solution becomes clouded when raised to the boiling point, and deposits tartrate of barytes, formed by the elevation of the temperature. The precipitate then comports itself like a combination of tartralic acid, which is converted, at the temperature of boiling water, into tartrate of barytes. By decomposing it by means of diluted sulphuric acid, the first precipitate being separated by the addition of alcohol, we obtain by the evaporation of the liquid, in a vacuum, in addition to sulphuric acid, a viscous liquid, having all the properties of tartralic acid.

It is very probable, that in the syrup of tartaric acid of the pharmacopœia, this acid also exists, under the form of tartralic acid. If, then, the cane sugar is converted, by means of tartaric acid into grape sugar, as we have long since known, it is not less true that in this mutual action the sugar also reduces the acid to the state of tartralic acid.

To obviate any objection that may be made, by attributing the strong tendency of the mixture to absorb water, to the greater state of division in which the tartaric acid exists, in consequence of its mixture with sugar, I exposed a mixture of tartaric acid and gum arabic, to the action of moist air. This mixture did not become more moist than the tartaric acid itself in an isolated state, and I was able to separate the tartaric acid from it, in the form of well-decided crystals, by means of alcohol, or even water. The tartaric acid, therefore, undergoes no decomposition in moist air, when it is mixed with gum.

SUMMARY.

It results from the above experiments:—

1. That a mixture of sugar and tartaric acid, absorbs the water of the atmosphere much more rapidly, and in greater quantity, than when the two substances are separately exposed to the action of damp air.

2. That neither the sugar nor the tartaric acid can be separated from the mixture, when dissolved by the moisture of the air, with their primitive characteristics, that is to say, under the form of crystals.

3. That the tartaric acid is transformed, by its mixture with sugar and water, into tartralic acid.

ON CRYSTALLOGRAPHY, WITH A DESCRIPTION OF A GONIOMETER AND CRYSTALLONOME, OR INSTRUMENT FOR STUDYING CRYSTALS IN REFERENCE TO THEIR GUBERNATORIAL AXES.*

BY DR. LEESON.

This paper on the subject of Crystallography was read before the Chemical Society, on the 2nd of March last.

The author commenced by observing, that discriminative chemical researches have not received that assistance from crystallography which might reasonably be expected from the natural distinction of form peculiar to various different substances.

The particular design of the author's present paper was to introduce greater facility and simplicity in the classification and determination of crystalline forms, both by improved methods of observation, and also by a system of classification founded on the three gubernatorial axes, for the happy discovery of which we are indebted to Weiss, by whom, however, as well as by others who have succeeded him, systems have been proposed by no means realising that simplicity and perfection of which the fundamental principle is believed to be susceptible.

To prove that the nomenclature and classification of the different authors were both confused and complicated, various tables were referred to, showing the systems respectively adopted by them; by referring to which it was apparent that different authors used the same terms for totally different fundamental forms, and also that by many of them terms were employed, which having reference simply to the *number* of planes bounding a given system, were in fact, as subsequently demonstrated, applicable to every class and order, and therefore not *discriminative* of any one in particular.

Any one who may have carefully examined the first crystals depositing from solutions

* *Chemical Gazette.*

of different substances, will be struck by the general prevalence of the prismatic or hexahedral form, or of some modification thereof; at the same time he will observe great variety in the *number* of planes bounding many of the crystals. Under the microscope he will not only be struck by the general prevalence of parallelograms, or sections of the prismatic forms, as well as hexagons, triangles, and other sections resulting from hemihedral modifications, but also by the *prima facie* similarity of the sectional forms presented by totally different substances. It is in the discrimination of these forms that the principles of classification now about to be proposed, and the goniometer subsequently described, are peculiarly applicable.

Before describing the system itself, the author requested to explain an instrument which he exhibited, and stated he had contrived some years ago, for the purpose of studying the relative character of crystals derived from different positions and length of the three gubernatorial axes, and for which instrument he requested to propose the name *crystallonome*.

The author showed with that instrument, that whatever be the length and relative position or inclination of the three axes, a prism or hexahedron must necessarily result from a set of planes terminating the extremities of the respective axes, such planes terminating one axis and being parallel to the other two axes. These planes were represented by a contrivance for attaching pieces of stiff paper or card-board to the extremities of the axes.

The author then showed that an octahedron must necessarily result in every case from a set of planes cutting all three axes, and which octahedron might easily be built up and represented by threads connecting the extremities of all the axes. The construction of other forms was also demonstrated.

The crystallonome, although constructed with only three zones placed at right angles with each other, is nevertheless capable of showing the position of the axes in every class, even where all the axes are oblique. This was illustrated by the instrument itself. It was also shown, that whatever be the class and order of a crystal, there are always two zones in which all three axes will be found.

It having been already stated that the three gubernatorial axes form the basis of the proposed system, it will be evident that the discriminative principles of the system must be dependent on the position and length of the respective axes.

Since the relative position of the axes occasions the greatest difference in the appearance and character of a crystal, it seems natural to take that as determining the class; and we shall find that, as regards this distinctive character, there are but three classes to which the variation of position can give origin, viz.—1st, where all the axes are situated at right angles to each other; 2nd, in which one axis is at right angles to the other two, which are obliquely placed as regards each other, one rectangular axis and two oblique, being in fact the same as though we represented it as two rectangular axes and one oblique; 3rd, in which all the axes are oblique to each other.

We have thus three classes, which we term respectively,—1st, rectangular; 2nd, right oblique; 3rd, oblique; and these we again subdivide into three orders, dependent on the relative length of the axes, viz.—1st, all the axes equal; 2nd, two axes only equal, the third being longer or shorter than the other two; 3rd, all the axes of different lengths. These orders we term,—1st, equiaxial; 2nd, binequiaxial; 3rd, inequiaxial.

With these three classes and three orders we obtain nine distinct crystalline bases, which the author trusts will be found easy to remember and simple to distinguish.

Generally speaking, few substances will be found to crystallise in forms belonging to distinct classes or orders; without, however, passing any opinion on the subject of dimorphism, the author showed, by reference to the native crystals of sulphur and also those obtained by fusion, that according to the system now proposed sulphur cannot be considered as dimorphous; the native crystals being in fact modifications of the octahedrons or the rectangular inequiaxial system, whilst those of fusion are prisms or hexahedrons belonging to the same system. Both were exhibited to the meeting, and the goniometer subsequently described applied to the measurement of the angles of the crystals of fusion. Whilst a chemical substance usually crystallises in forms pertaining to the same class and order, it may nevertheless, as has been already shown, assume a greater variety of forms if reference be had only to the number of bounding planes, and these forms constitute what may be termed the genera of the author's system, which were shown by reference to diagrams, as also the symbolic notation recommended by the author.

The author concluded by exhibiting his goniometer, consisting of a double refracting prism placed in a vernier revolving round a graduated circle, and applicable either to the microscope or to crystals placed on any convenient stand. He stated, that in most

cases of crystallisation, particularly under the microscope, some crystals will be observed presenting the prismatic or hexahedral form; and knowing that the gubernatorial axes of any prism must terminate in the centre of the sides of that prism, we are at once directed to the position and length of the axes in any given crystal; whilst by examining the angles formed by the sides of the parallelogram constituting the section of the prism with the goniometer, we may determine the inclination of the several axes.

In all natural octahedrons formed by inaxial planes, the axes will be found, as shown by the crystalionome, by taking the points where four planes meet. Although octahedrons may be mathematically formed by biaxial planes, that is by bending in the sides of the prism, it is believed that such octahedrons do not occur in nature, as it would contradict the general laws of symmetry, inasmuch as whilst the perpendicular axis terminated at the meeting of four planes, the middle and transverse axes would be situated in the centre of an edge bounding two planes; a state of things that could not certainly occur in the regular system; the general condition of natural symmetry being that whatever disposition takes place at any one extremity of an axis of equal length, the same will take place at its other extremity, and also at the extremities of every other axis of equal length.

ZININ ON THE ACTION OF SULPHURETTED HYDROGEN ON SEVERAL NITROGENATED BODIES.*

BY M. GERHARDT.

We are acquainted with the interesting reactions M. Zinin observed between sulphuretted hydrogen, or, hydrosulphate of ammonia, and several organic, nitrogenated substances, the author has continued his researches on this subject, and they have produced not less remarkable results.

THE DECOMPOSITION OF AZOBENZIDE.

Azobenzide is that beautiful crystallised substance, obtained by M. Mitschelich, by treating nitrobenzide (nitrobenzine of Gerhardt) with alcoholic potash, azobenzide dissolves in alcohol, saturated with ammoniacal gas, becoming of an orange colour; when this liquid is saturated with sulphuretted hydrogen, it changes colour, becomes yellow, then brown, and deposits, when heated, a considerable quantity of sulphur, in powder, and again becomes clear. The boiling liquid, separated from the sulphur, deposits brilliant leaf-like crystals, which are to be purified by dissolving them in boiling alcohol, and adding diluted sulphuric acid, until no further precipitate is formed. The precipitate is washed in alcohol, then dissolved in boiling ammonia, and we thus obtain white and shining plates of a new alkaloïd, which M. Zinin calls benzidine.

This body is soluble in a slight degree only, in cold water, but boiling water dissolves a considerable quantity, alcohol and ether still more readily dissolving it. It is without smell, and its solutions have a bitter, alkaline, and peppery taste. It melts at about 226° F., and, at a more elevated temperature, it concludes by being partly decomposed.

With acids, it forms well marked salts, which are decomposed by ammonia, as well as by the fixed alkalies.

Benzidine contains, according to three analyses, agreeing well with each other, C^{12}, H^{12}, N^2.]

The *sulphate* is almost insoluble in boiling water and alcohol; sulphuric acid, if not too much diluted, also, precipitates it from the solutions of benzidine, under the form of a dull white powder. If the solution should be very much diluted, the precipitate possesses a silvery appearance, and is composed of microscopic scales. They contain C^{12} H^{12} N^2, SH^2 O^4.

The *phosphate* is, also, nearly as insoluble as the sulphate.

The *hydrochlorate* is extremely soluble in water, still more so in alcohol, and almost insoluble in ether, it crystallises in thin and shining rhombs, unchangeable in the air; it contains C^{12} H^{12} N^2, 2HCl.

The *chloroplatinate* is yellow, and crystalline, but little soluble in water, and almost insoluble in alcohol and ether. Boiling water decomposes it. A determination of the platina, gives us the composition of this salt, C^{12} H^{12} N^2 2(HCl, $PtCl^2$.)

The *nitrate* crystallises in rectangular leaflets, soluble in water. Concentrated nitric acid destroys the alkaloïd.

The *oxalate* is a white salt, yielding radiated, silky crystals, but slightly soluble in alcohol and water, and containing C^{12} H^{12} N^2, C^2 H^2 O^4.

M. Zinin, also, notices a few facts respecting the *tartrate*, the *acetate*, and the *benzoate*, of the new base. It is singular that the composition of the preceding salts corresponds with that of acid salts; the hydrochlorate is, above all, remarkable for containing two equations of hydrochloric acid, for it does not appear to me to be possible to double the formula of the benzidine, be-

* *Journ. de Pharm., Feb.* 1846.

cause we have not an even number for the sum of the hydrogen and nitrogen.

Chlorine decomposes benzidine as well as the salts of that alkaloïd, either in an aqueous or alcoholic solution. The solution sometimes assumes a fugitive indigo tint, which afterwards becomes of a deep brown, at the same time a large quantity of a crystalline powder is precipitated, of the colour of vermilion, almost insoluble in water, but soluble in alcohol.

FORMATION OF AZOBENZIDE.

We may, says M. Zinin, attribute the formation of azobenzide to a deoxidizing power of alcohol over nitrobenzide, when in the presence of potash. Still the reaction is not quite simple, for the formation of azobenzide is accompanied by that of other products; in fact, after the distillation of the alcoholic solution of nitrobenzide with potash a considerable quantity of charcoal remains in the retort, and the receiver contains, in addition to azobenzide, a considerable quantity of aniline.

Further inquiry into this reaction has proved that the azobenzide is not produced directly.

When we dissolve one volume of nitrobenzide in eight or ten volumes of concentrated alcohol, and add to this solution a quantity of dry caustic potash, equal in weight to the azobenzide, the liquid assumes a brown tint and increases in heat until it boils. We agitate the mixture well, and keep up the ebullition for several minutes. As it cools it sometimes deposits crystals of a brown colour; we pour off the supernatant liquid, and distil it, until two layers are formed. The uppermost layer is brown and butter-like, and after it has been poured off, and washed in water, it thickens into a mass of brown needles. The lower layer is an aqueous solution of caustic potash, carbonate of potash, and another salt of potash, brown, and almost insoluble in alcohol.

The liquid is pressed out of the crystals, and they are recrystallised in alcohol or ether; the colour may be easily removed by passing a current of chlorine through their alcoholic solution. They then rapidly lose their brown tint, and become of a brimstone yellow, in this manner we obtain them in glittering quadrilateral needles; in ether, by spontaneous evaporation, they often attain the length of an inch, and a diameter of half a line. Two parts of nitrobenzide clearly yield one part and a half of this new body, when entirely purified.

It is as hard as sugar, without either taste or smell, and it is not soluble in water.

M. Zinin calls it *azoxibenzide*, it melts at about 97° F., and, as it cools, it assumes the appearance of a radiated mass. Hydrochloric acid, diluted sulphuric acid, potash, and liquid ammonia, have no effect upon it.

It resists the action of chlorine, both in its alcoholic solution and when melted.

Diluted nitric acid has little effect upon it, but the vaporous acid dissolves it at the ordinary temperature, it becomes heated, gives off red fumes, and produces two crystallisable bodies.

Hot concentrated sulphuric acid dissolves the azoxibenzide, and appears to produce a compound acid.

Submitted to dry distillation, azoxibenzide yields, in the first instance, a liquid product, and afterwards a greasy and a crystalline substance. And the retort contains an abundant residuum of charcoal. The liquid portion is merely aniline, the crystals consist of azobenzide.

Two combustions of azoxibenzide gave—

1. Carbon .. 72·57 Hydrogen .. 5·27
2. ,, 72·72 ,, 5·25

and a determination of the nitrogen in the state of gas (13·99) caused M. Zinin to adopt the formula:—$C^{12} H^{10} N^2 O$, which requires, carbon, 72·60; Hydrogen, 5·04; Nitrogen, 14·28.

The analyses accord, therefore, with this formula, but it is impossible to deduce the formation of the azobenzide and aniline, by means of heat, or to account, when taking this formula as a base, for the production of azoxibenzide.

Still, one fact incontestibly springs from the foregoing experiments; which is, that the azobenzide is not, as it was believed to be, the direct product of the action of potash on the nitrobenzide.

M. Zinin promises to return to the metamorphoses azobenzide and azoxibenzide undergo by the action of nitric acid.

DECOMPOSITION OF NITROBENZOATE OF AMMONIA BY SULPHURETTED HYDROGEN.

When we boil an alcoholic solution of nitrobenzoic acid, saturated with ammonia, and sulphuretted hydrogen, it becomes green and cloudy, and sets at liberty a large quantity of sulphur as it becomes clear again. To obtain a complete decomposition, it is necessary to pour off the liquid portion, mix it with ammoniacal alcohol, which has been condensed in a receiver during ebullition, saturate with sulphuretted hydrogen, and redistil it. This operation ought to be repeated two or three times, until no more sulphur is deposited. Finally, we concentrate the liquid, until it is of the consistence of syrup, we supersaturate it with concentrated acetic acid, collect, upon a filter, the thick

mass formed by means of the acid; allow it to drain, and after having dried it on a porous brick, we dissolve it in distilled water, remove the colour by means of animal charcoal, and filter the boiling solution. In this manner we obtain small, white, lamellated masses, composed of minute needles, arranged in a radiated form, in obtaining which our success was constant.

M. Zinin proposes to call this new body benzamic acid; it is, in fact, an azotated acid.

Alcohol and ether dissolve it even better than boiling water; cold water does not so readily dissolve it.

It is colourless—but sweet-flavoured, and rather tart. The solution is gradually changed when in contact with air, and produces a brown resin.

Submitted to the action of air, it melts, swells, and gives out acrid fumes, resembling those of benzoic acid, and, at the same time, a voluminous charred mass is left behind.

Its solution is easily decomposed by means of chlorine, which produces a resinous substance, soluble in alcohol, and of a violet colour.

Common nitric acid scarcely attacks it, even at a boiling heat; but the smoking acid decomposes it. Concentrated sulphuric acid dissolves it at the ordinary temperature, without becoming coloured: the solution becomes yellow when heated, loses its colour by the addition of water, and, when once neutralised, it yields, with the salts of copper, a green precipitate.

Benzamic acid has a very strong acid reaction, perfectly saturates the bases, and displaces the carbonic acid.

Its salts, with alkalis or alkaline earths for a base, are extremely soluble in water and alcohol, but have not been obtained in a crystalline form. It appears to form three different salts with lead, of a white colour, two of which are crystallisable; it yields, with copper, an insoluble green precipitate.

The salts of silver give a curdled white precipitate, with a solution of benzamate of ammonia, which is ultimately changed into a crystalline powder. The latter becomes of a brownish-violet colour in boiling water, but without dissolving. In a dry state, the salt of silver swells on the application of heat, gives out acrid fumes, and leaves a charcoal, which can be completely burnt, so that nothing is left but pure silver.

M. Zinin has analysed the acid and the salt of silver; his experiments conducted him to the following formulæ:—

Benzamic acid.. .... $C^7 O^7$ NO^2

Benzamate of silver .. C^7 (H^6 Ag.) NO^2

We see by this that the benzamic acid of M. Zinin is of the same composition as the anthranilic acid of M. Fritzsche, and the salicylamide of M. Cahoun. It does not yield aniline by dry distillation.

Its composition is easily understood, because $C^7 H^5 NO^4 + 3 H^2 S = 3 S + 2 H^2 O — C^7 H^7 NO^2$. Nitrobenzoic acid, $C^7 H^5 NO^4 = C^7 (H^5 X) O^2$, therefore yields, under the influence of sulphuretted hydrogen, sulphur, water, and benzamic acid.

M. Zinin has not examined the action of alkalis on this new acid; we are, therefore, unable to say, whether it is a true amidated acid. But the alkalis cannot convert it into ammonia and benzoate; they would rather produce salicylate, for

$C^7 H^7 NO^2 + H^2 O = NH^3 + C^7 H^6 O^3$.

In any case, it is worthy of remark, that the benzamic acid of M. Zinin, only differs from benzamide by one equivalent of oxygen.

ON THE FREEZING OF WATER BY THE AIR-PUMP, WITHOUT THE AID OF SULPHURIC ACID OR ANY OTHER DESICCATING AGENT.*

BY J. LAWRENCE SMITH.

In attempting to freeze water under the air-pump, without the aid of a desiccating agent, the cooling of the water to the point of congelation is prevented by the heat received from the containing vessel. I have lately found, that, by obviating this difficulty, water may be readily frozen by its own evaporation.

It was first shown by Count Rumford, that water does not wet a sooted surface, but forms in globules like quicksilver. Three drops of water were placed in a sooted watch-glass; the spheroidal globule lay on the soot, exposing a large surface for evaporation, at the same time that the water was insulated from any source of heat. Arranged in this manner, and placed under an air-pump, two or three minutes were sufficient to freeze the water. The glass was sooted over an oil-lamp, with great care; the experiment fails if the globule of water touches the glass even by a small point.

In place of the sooted watch-glass, make a shallow cavity in the end of a large cork, and over a lamp burn it, sooting it at the same time. By putting three drops of water into the cavity thus prepared, and subjecting it to the action of the air-pump under a pint receiver, the water solidified in 1¼ minute; and in 2¾ minutes 20 grs. of water congealed, though at 73° F. when introduced. Under a

* *Silliman's Journal*, March, 1846.

receiver of three quarts capacity, 20 grains of water froze in four minutes. I could not succeed in freezing the same amount in the sooted watch-glass.

By placing corks, prepared as above, over a saucer of sulphuric acid, the same results are obtained more rapidly. I put half a drachm of water, at 65° F. in each cavity, and exhausted the receiver till the mercurial gauge reached four-tenths of an inch, which was effected in one minute. In 1½ minute the water on one cork began to freeze, and in five minutes they were all frozen. An ounce of water in a large flat cavity froze in 3½ minutes.

A flat-bottomed porcelain capsule was prepared for an experiment on a large scale, by sooting it in the following manner:—After coating it with soot over a lamp, and allowing it to cool a little, a small quantity of oil of turpentine was carefully poured upon the edge and passed over the entire surface; the vessel was then warmed, to drive off the redundant turpentine. The surface was again coated with soot, and again with turpentine, and this process was repeated a third time; finally, another coating of soot was added, when it was ready for use. Two ounces of water were placed in this capsule under a receiver, and the air-pump worked for one minute. After standing six minutes, the surface was frozen.

This experiment, as well as similar ones, was attended with violent ebullition on the part of the liquid, throwing the water against the sides of the receiver, which was owing to the rapid formation of vapour on the under surface of the liquid.

ON THE PRODUCTS RESULTING FROM THE DESTRUCTIVE DISTILLATION OF THE VALERIANATE OF BARYTES.*

BY G. CHANCEL.

The salt with which the following experiments were made had been prepared from an acid obtained directly from valerian. It is white, soft to the touch, crystallises in small transparent shining prisms, and contains two equiv. or 9·5 per cent. of water of crystallisation; it effloresces by exposure to the air, losing from 2 to 2·5 per cent. water. The salt dissolves readily in water. To test the purity of the acid, it was combined with oxide of silver, and analysed, when it yielded exactly the formula of the valerianate of silver, $C^{10} H^9 O^3 + AgO$. At 662°, the valerianate of barytes loses only its water of crystallisation; heated more strongly, it begins to be decomposed, and disengages a gas which burns with a very luminous flame, and at the same time some slightly-coloured drops of a powerfully smelling liquid. The decomposition is complete only at a low red heat; the residue is carbonate of barytes, mixed with a small quantity of carbon.

By repeated rectification of the crude distillate, a liquid is finally obtained, which boils at about 230°, and which the author calls *valeral* or *valerianic aldehyd*. It is clear and colourless, very fluid, has a burning taste, and a most powerful penetrating odour, is insoluble in water, but soluble, in all proportions, in alchohol, ether, and the essential oils. Its specific gravity at 72° is 0·820.

Valeral is readily inflammable, and burns with a bright bluely-fringed flame. Oxidizing agents convert it generally into valerianic acid, as does likewise oxygen in contact with platinum-sponge. Nitric acid yields with it, under violent reaction, a liquid which is denser than water, and in every respect similar to the nitro-butyric acid, on which account the author calls it *nitro-valerianic acid*. In the formation of this body, nitric oxide and a colourless gas are given off, which is easily inflammable, and burns with a very bright flame. The analysis of valeral yielded—

Carbon....	69·0	69·8	69·5	10	= 750	69·8
Hydrogen	11·6	11·8	11·9	10	125	11·6
Oxygen ..	18·6	18·4	18·6	2	200	18·6

The specific gravity of the vapour was found to be 2·93: according to calculation it is 2·96. Löwig, who first examined the products of the dry distillation of valerianic acid, states that he obtained pure valeron; but this would require far more carbon (76 per cent.) than the above analyses show. In the dry distillation of the valerianates, two equivs. of the acid take part in the decomposition:—

$$(C^{10} H^{10} O^4) + 20 = C^{10} H^{10} O^2 \text{ Valeral.}$$
$$(C^{10} H^{10} O^4) + 20 - C^2 O^4 - H^2 O^2 = C^8 H^8 \text{ Butyrene.}$$

Valeron is a compound of the two bodies, $C^{18} H^{18} O^2 + C^{10} H^{10} O^2 + C^8 H^8$. The gases therefore which are evolved during the dry distillation of the butydrate of barytes, are perhaps only butyrene.

* *Comptes Rendus.*

NEW TEST FOR PRUSSIC ACID.*

BY DR. RANKIN, JUN.

HAVING had occasion lately to repeat the ordinary tests for prussic acid, it occurred to my mind, that if we could form the sulphocyanuret of potassium, by fusing together the cyanide of silver, sulphur, and carbonate of potash, we should, in like manner, be able to form the ferrocyanuret of potassium, by fusing together oxide of iron, carbonate of potash, and cyanide of silver; and I accordingly tried it, but not successfully on the first occasion, having added a great excess of carbonate of potash, which, when I added a solution of sulphate of copper, occasioned a muddy bluish precipitate of hydrated oxide of copper, mixed with some ferrocyanide of copper. I then added a few drops of muriatic acid, so as to have the acid slightly in excess, when immediately the ordinary chocolate-coloured precipitate of ferrocyanide of copper was obtained.

Now, I consider this mode of application of the copper test a very valuable addition to our ordinary tests for prussic acid, being so exceedingly delicate. No doubt the combustion of the cyanogen afforded by the cyanide of silver giving the rose-coloured flame is extremly characteristic, and especially so when combined with the other tests, and as far as we are acquainted, not subject to fallacy; but then, this requires us to obtain a tolerable quantity of cyanide of silver, both for the gaseous and liquid tests, whereas I have been able, with half a grain of cyanide of silver, fused with carbonate of potash and oxide of iron, when dissolved in half an ounce of water and filtered, to obtain a most decided brown colouration of the solution, when a drop or two of the solution of sulphate of copper was added; again, as to the sulphocyanuret of potassium, when mixed with solution of sulphate of iron, giving it a blood red colour, although this can be distinguished from the solution of meconate of iron, by protonitrate of mercury, destroying the colour of the one, and leaving the other undisturbed; yet, from the great variety of new organic acids, and those likely to be discovered, it is not at all improbable with some of these, a red-coloured solution may be formed with a salt of iron; but this application of the copper test is so easily performed, by even the most inexperienced manipulator, as at once, in my opinion, to supersede the ordinary tests.

I shall, therefore, very briefly detail the mode in which this test may be performed, premising, in the first instance, that we have obtained only half a grain of cyanide of silver; mix this with a small quantity of oxide of iron and carbonate of potash, fuse these together in an iron or platinum capsule, dissolve in half an ounce of distilled water, filter and divide the filtered liquor into two portions, to each portion add a drop or two of muriatic acid, so that the acid may be slightly in excess, to one portion add a few drops of solution of sulphate of copper, when immediately the solution assumes the chocolate brown, so characteristic of the ferrocyanide of copper; to the other, add a few drops of mur. tinct. iron, or any per-salt of iron, when the solution becomes intensely blue, by the formation of the ferrocyanide of iron, the ordinary prussian blue.

These two tests, with the well known odour of prussic acid, are, in my opinion, independent of all others, sufficient to convince the medical jurist of the presence of free prussic acid.

* *Dublin Hospital Gazette.*

ON THE CONSTITUTION OF THE HYPOPHOSPHITES.*

BY A. WURTZ.

THE author prepared almost the whole of these salts, which he analysed, by the double decomposition of soluble sulphates with hypophosphite of barytes. The most economical method of preparing the last-mentioned salt, is to boil a solution of sulphuret of barium with phosphorus, until gas ceases to be evolved. If the ebullition has been long continued, the sulphuret of barium is almost entirely decomposed, and a slight excess only is left, which may be separated by carbonate of lead. Sometimes, however, the excess of sulphuret is more considerable; it is then best separated by cautiously adding small quantities of sulphuric acid to the hot filtered liquor, as long as sulphuretted hydrogen is disengaged. If the liquor becomes acid, it must be neutralized, before evaporation, by a little carbonate of barytes.

HYPOPHOSPHITE OF POTASH.

This salt was prepared by the double decomposition of hypophosphite of barytes and sulphate of potash. The aqueous solution was evaporated to dryness, and the residue, treated with hot alcohol, deposited hypophosphite of potash on cooling. The crystals of this salt are hexagonal tables. They are very deliquescent, very soluble in weak alcohol, less so in absolute alcohol, and in-

* *Ann. de Chim. et de Phys.*, and *Chemical Gazette.*

soluble in ether. They lose no water at 212° F.

Adopting, with M. Pelouze, 400 as the atomic weight of phosphorus, M. Wurtz gives as the formula of this salt, PO, KO, 2HO = PH^2O^3, KO.

HYPOPHOSPHITE OF AMMONIA.

This salt was prepared like the preceding. It crystallises in large irregular hexagonal laminæ; it is less deliquescent than the salt of potash, and unalterable at 212° Fahr. At about 394° Fahr., it fuses into a transparent liquid without losing water, and becomes a crystalline mass on cooling. It does not decompose under 464° Fahr., at which temperature, like other hypophosphites, it disengages a little water and spontaneously inflammable phosphuretted hydrogen. Its formula, as determined by analysis, appeared to be PO, H^2N 3HO = PH^2O^3, NH^4O.

HYPOPHOSPHITE OF STRONTIA.

This salt was prepared like that of barytes, by boiling a solution of sulphuret of strontium with phosphorus, and decomposing the excess of sulphuret by carbonate of lead, or by sulphuric acid added in sufficient quantity to render the liquid slightly acid. By evaporation, the hypophosphite of strontia crystallises in the mamillated form by the juxtaposition of small laminæ round a common centre. These crystals are unalterable in the air, and lose no water at 212°. They are very soluble in water, and insoluble in alcohol. The formula of this salt is PO, SrO, 2HO = PH^2O^3, SrO.

HYPOPHOSPHITE OF MAGNESIA.

This salt was prepared by double decomposition with sulphate of magnesia and hypophosphite of barytes; it crystallises, as stated by M. H. Rose in very brilliant regular octahedrons, which effloresce in dry air. The formula of the crystallised salt is PH^2O^3, MgO+HO+5Aq; of the salt dried at 212°, PH^2O^3 MgO+HO; and lastly, the formula of the salt dried at 360° Fahr., is PH^2O^3, MgO.

HYPOPHOSPHITE OF ZINC.

This salt was obtained of two different forms. It crystallises sometimes in very efflorescent regular octahedrons, and sometimes in small rhombic crystals unalterable in the air. When a moderately concentrated solution of this hypophosphite is submitted to spontaneous evaporation, the first-mentioned crystals are usually formed. They are so efflorescent, that they lose water during pressure between folds of paper, previous to analysis. The formula of the rhombic crystals is PH^2O^3 ZnO + HO.

HYPOPHOSPHITE OF IRON.

This salt crystallises in large green octahedrons, which effloresce by exposure to the air and become a white powder. When exposed to the air, the moist salt absorbs oxygen from it rapidly. The formula of the crystallised salt is PH^2O^3, FeO + 6HO.

HYPOPHOSPHITE OF CHROMIUM.

This salt was prepared by double decomposition by mixing solutions of sulphate of chromium and hypophosphite of barytes. By evaporation there was obtained an amorphous, cracked mass of a very deep green colour. This salt loses water by drying when it has been heated to 392° Fahr.; it is not soluble either in water or dilute acids. The formula of this salt is $2PH^2O^3$, Cr^2O^3 + 4HO.

HYPOPHOSPHITE OF MANGANESE.

The crystals of this salt are of a rose colour, brilliant and unalterable in the air. They do not lose water at 212° Fahr., but at about 302° Fahr. they part with one equivalent. The formula of this salt is PH^2O^3, MnO + HO.

HYPOPHOSPHITE OF COBALT.

This salt forms large crystals of a deep red colour, which effloresce in the air. At 212° Fahr., they lose six equivalents of water of crystallisation, and become a pale rose-red powder. The formula of this salt, which agrees with that of M. H. Rose, is PH^2O^3, CoO + 6HO.

HYPOPHOSPHITE OF NICKEL.

The crystals of this salt are regular octahedrons, and smaller than those of hypophosphite of cobalt. When the aqueous solution is evaporated at the temperature of 212° Fahr., it is partially reduced to metallic nickel with the disengagement of hydrogen. This reduction takes place, perfectly, when the crystals of this salt, broken and slightly moistened, are exposed to the air at a temperature 248° Fahr. The formula of this salt is PH^2O^3, NiO + 6HO.

HYPOPHOSPHITE OF COPPER.

The solution of this salt is readily prepared by decomposing sulphate of copper with hypophosphite of barytes. It is not a permanent salt. At about 140° Fahr., it becomes turbid, and deposits hydrate of copper. By evaporating the solution *in vacuo*, small blue crystals of this salt were at once obtained. These crystals decompose quickly, and with projection of the entire mass when heated to 149° Fahr.; and phosphuret of copper is formed. The formula of this salt is PH^2O^3, CuO.

ON A NEWLY-DISCOVERED CHARACTERISTIC OF ALBUMEN, WITH PARTICULAR REFERENCE TO THE POSSIBILITY OF ITS BEING MISTAKEN FOR CASEIN.*

BY J. UNDERWOOD.

In Number 21, vol. ii., of the *Lancet* for 1845, (new series,) there is an article, by Dr. Ure, upon the potato malady, and to the following paragraph, extracted therefrom, I would beg to call particular attention, as it is very likely to mislead those who are not conversant with the late discoveries in organic chemistry.

"Liebig imagines the essence of the disease to consist in the conversion of the albumine, a usual constituent of healthy potatoes, into casein—a principle which, by its great instability of composition, is supposed to cause the potato to putrefy rapidly. I have subjected this opinion to the test of experiment. Perfectly sound potatoes, as also diseased ones, were sliced or grated, and separately digested in a very dilute alkaline ley at a blood heat. The infusions, when cool, being filtered and faintly acidulated with dilute acetic acid, afforded, respectively, a like proportion of casein-looking flakes. It would thus appear, from this mode of testing, as prescribed by Dumas, in the seventh volume of his '*Traite de Chimie*,' that sound potatoes contain as much casein as unsound."

But I suppose Dumas and Ure, both of them, forget that Mülder, of Amsterdam, some time back discovered that when either albumen, casein, or fibrin were dissolved in caustic alkali, these solutions precipitated, upon the addition of a little excess of acid, a substance in appearance identical with casein, but differing chemically therefrom in being a compound simply of carbon, hydrogen, nitrogen, and oxygen, while casein is a compound of carbon, hydrogen, nitrogen, oxygen, and sulphur. To this substance he gives the name of protein, supposing that it is the common fundamental principle of albumen, casein, and fibrin, which it forms by uniting with certain small quantities of sulphur, or sulphur and phosphorus, and which latter bodies are separated by the alkali, and retained in solution. When the protein is precipitated by an acid, the precipitate obtained therefrom by Ure was not casein, but the protein of Mülder; or we are justified in supposing this to be the case till Ure or Dumas shall have proved by ultimate analysis that it is not.

There is another test for albumen to which Ure doubtless did, or at any rate ought, to have had recourse, though he does not tell us so—that is, the supposed property of all albuminous fluids to coagulate by heat; and were this characteristic universal, it would be a good test; but I find, that when once we have dissolved albumen in caustic alkali, we are enveloped in many difficulties, from which time, perseverance, and experiment only can liberate us. I trust, ere long, to be able to do this; but for the present, I would only state my results as far as they go. I find, that when thus dissolved in certain proportions, it entirely loses the property of coagulating by heat, and that in proportions where it does not lose this property entirely, it does so to a great extent. A quantity of albumen is left in solution after all has been coagulated that heat will render insoluble, and protein is precipated from this solution upon the addition of a slight excess of acid.

I think, therefore, that until the various properties of albuminous fluids can be fixed by definite laws, the conflicting statements of Liebig and Ure must fall to the ground; and we must seek elsewhere for the grand fundamental cause of that change which has plunged many parts of our own, together with our sister country Ireland, into a state of destitution and want, than in the conversion of the albumen into caseine.

I trust that these remarks will throw the path open for other experiments, and that others will follow.

* *Lancet.*

EXPERIMENTS ON THE HEAT DISENGAGED DURING CHEMICAL COMBINATIONS.*

BY MESSRS. P. A. FAVRE, AND J. T. SILBERMANN.

This first memoir treats of the combustion of bodies belonging to the series $C^2 H^2$ and its derivatives, and the combustion of several bodies belonging to the formula $C^{20} H^{16}$.

After endeavouring to establish the number for hydrogen and carbon, with all the accuracy it was possible to attain, we thought we should be able to approach the study of bodies formed of these elements, by commencing with those whose analogies, M. Dumas has so clearly established, and by which he has constructed various series, which M. Gerhardt has happily named *homologous series.*

For the purpose of burning the substances, we employed the same apparatus and the same method of weighing the quantity when

* *Comptes Rendus.*

burnt. Beside the advantage of giving an exact weight, the weight of the carbonic acid, by augmenting the weight of the matter which can even be tripled, divides the errors that are inseparable from all modes of weighing.

When the substance is pure, complete desiccation is not even necessary, the water not intervening as a combustible body, and the weight of the matter being solely calculated by the carbonic acid produced by the combustion. The same bodies were burnt several times, and the results never varied by more than about thirty degrees of caloric, and that in the smallest number of instances.

NUMBERS OF THE COMBUSTION.

	Caloric.
Paramilène carburet	11491
Amilène carburet	11303
Carburet, boiling at 376°F	11262
Cetène carburet	11117
Metamilléne carburet	10928
Wood alcohol	5304
Wine alcohol	7183
Amilic alcohol	8959
Ethalic alcohol	10600
Sulphuric ether	9027
Amilic ether	10188
Formic acid	1712
Acetic acid	3405
Butyric acid	5623
Valeric acid	6439
Ethalic acid	9316
Stearic acid	9716
Acetone	7320
Ethalic aldehyd	10342
Stearic aldehyd	10500

COMPOUND ETHERS.

It is important that they should be perfectly free from the least excess of acid or alcohol.

Formiate of methylen	4197
Formiate of alcohol	5187
Acetate of methylen	5342
Acetate of alcohol	6300
Butyrate of methylen	6776
Butyrate of alcohol	7096
Valerate of methylen	7376
Valerate of alcohol	7835
Amylic acetate of alcohol	7971
Valeramylic ether	8544

BODIES BELONGING TO THE FORMULA $C^{20}H^{16}$.

Essence of turpentine	10874
Essence of lemon	10959
Terebène	10668

The preceding figures enable us to draw the following conclusions :—

It is wrong to say that by removing the oxygen in the form of water, the remaining elements will show the same amount of caloric, as they would have done when at liberty.

Amylic alcohol is the only one that is apparently opposed to the theory that the alcohols are corresponding binhydrates of carbonated hydrogen.

The numbers of the alcohols do not oppose the theory that they are hydrates of ether.

The examination of the two ethers we burnt, gave a higher number than the corresponding isomerous alcohol ; a clear proof that the most complete isomery does not bring with it isothermy.

The numerous compound ethers which are so completely isomerical with the acids, of the series we have studied, and with each other, are not isothermal. The only instance of isothermy we discovered during our labours, occurred between the acetone, and the valerate of methylen, both isothermal, but the first having less density.

On the other hand, are the ethers binary compounds ? With the exception of one instance, the formiate of alcohol, they all exhibit a higher number than that of their elements when uncombined.

If we consider the aldehyds in connexion with their corresponding carburets, having subtracted the two equivalents of oxygen, the carburet that remains will give more caloric than if it was uncombined. There is no such thing then as binary combination ; nevertheless, it must be observed, the oxygen that is found united with the carburet, cannot be considered as oxygen that supports the combustion of bodies, when free ; it occupies a double space. What is the heat that is absorbed during this bisection ? This is an important question to clear up ; the oxygen consumes the hydrogen of the body, as well as its carbon, producing a greater degree of heat. The same thing occurs in the case of protoxide of nitrogen gas ; the combustion of carbon has a higher figure, when this gas is employed, evidently occurring because the oxygen, assuming a double volume, has received more heat than it lost, by uniting itself with the nitrogen. We apply the same reasoning to the carbon of methylen, cyanogen gas, &c., in relation to the carbon we have already studied ; we thus, also, are deficient of an essential element to discover the law that guides the loss of heat in molecular groups. The experiments we made to discover the true number of carbon, necessarily show our belief in molecular groupings, between molecules of the same species, without reference to the phenomenon of simple cohesion.

Is the molecule of a simple body always of the same weight ? Numerous facts,

which have not escaped the notice of M. Dumas, induce us to admit the contrary; when taking its equivalent as = 1·05 a volume of the vapour of water; 0·25 in a volume of hydrochloric acid; 0·75 in a volume of ammonia. Is not nitrogen, = 14·17, in a volume of protoxide of nitrogen gas 3·5, in a volume of ammoniacal gas? Is not oxygen = 8, when uncombined, and in decidedly acid bodies, 4 in a volume of oxide of carbon, alcohols, ethers, acetones, aldehyds, &c.? In organic compounds, sugar for instance, where we must admit there would be more carbon than water; is not the carbon grouped by itself, without reference to cohesion, like the carburet, $C^2 H^2$ in metamilène, $C^{40} H^{40}$ where we may consider its alcohol as $C^{40} H^{10} + HO$ in the same manner as we may consider sugar as, $C^{12} + HO$? This tendency of carbon to arrange itself in stronger equivalents, may explain the fact of its nonvolatility; it is sufficient to consider the distance that in this view of the case separates methylene from metamilène. We are, therefore, led to admit that carbon, when uncombined, and when combined, may follow the same law as the carburets, of which we shall presently speak, a law of which we want the first clause. The carbon of wood would appear, in this case, when formed, to suffer an equal loss to that which the elements of methylen undergo in grouping themselves.

We attach to our memoir the line of the carburets and the curve of the derivatives we have been able to examine.

From the number given by each of six carburets of hydrogen, it results—

1. That the caloric diminishes with the elevation of its formula, and that the variations between each other are in arithmetical progression with their order $C^2 H^2$, $C^4 H^4$, $C^6 H^6$, &c.; this difference between each succeeding term is 37·5 caloric.

2. That olefiant gas, which gives 11·900, rises above the preceding line in sufficient quantity to volatilise its liquid.

3. That the caloric of component parts, isolated in the proportion of carbonated hydrogens, being 11·847, we should have, according to the following formula, by taking CoH = 11678·5, an imaginary liquid composed of the elements of carbon and hydrogen, in the state of simple liquid mixture, in all the carbonated hydrogens.

$$\text{Caloric of the liquid } Cn\,Hn = \left(\frac{Cn}{Cn + Hn} \times \frac{Hn}{Cn\,Hn} \times 34462\right) - \left(168{\cdot}5 + \frac{n \times 37{\cdot}5}{2}\right)$$

$$= 11847 - \left(168{\cdot}5 + \frac{n \times 37{\cdot}5}{2}\right)$$

The number 168·5 = 11847 — 11678·5.

The caloric of the derivatives of carbonated hydrogens, produce hyperbolic curves, more or less open, they are constructed, like the preceding line, by raising on each combination taken, for the ordinate abciss of the length that expresses the caloric, the body in question has produced.

The three carburets of the formula $C^{20} H^{16}$ have also just proved that isomery does not bring isothermy along with it.

We shall conclude by saying, that our apparatus, besides its great correctness, enables us to operate quickly, for we have often performed eight combustions in the course of one day, while it is difficult to make more than three organic analyses in the same space of time.

ON THE ATOMIC WEIGHT OF URANIUM.*

[BY M. E. PELIGOT.

When I had the honour of submitting to the judgment of the Academy, my first work on uranium, I proposed, in the number of the modifications the history of that metal ought to receive, to replace them by 750, the number 2711 that was employed to represent the atomic weight of protoxide of uranium, then considered to be a simple body.

Sometime after the publication of my work on uranium, M. Ebelman gave us an account, in his researches into several compounds of urania, of the results at which he had arrived, for the determination of the atomic weight of that body, which he fixed at 742·87.

At a later period, M. I. Wertheim, in the course of experiments made at the laboratory of M. Mitscherlich was led by the analyses of the double acetate of urania and soda, to adopt the number 746·36.

It clearly results from these different experiments, that the true atomic weight of urania, is comprised between the numbers 740 and 750. By adopting either of these numbers, we give the same interpretation to all the compounds of this metal, and satisfy the present exigencies of science.

As M. Berzelius, however, appeared to give the preference to number 800, notwithstanding this number disagreed with every

* *Comptes Rendus.*

analysis worthy of confidence, which has been executed, of late years, on the compounds of uranium, I thought it would not be uninteresting to submit the determination of the atomic weight of this metal to fresh experiments.*

For this purpose, I performed a double series of analyses, one on the oxalate of uranium, the other on the acetate. I had previously employed the latter salt as much as four years back, to determine, by the relation the weight of carbon bore to oxide of uranium, the atomic weight of uranium.

These two salts are preferable to the other compounds of uranium, on account of the facility with which they are obtained in the state of crystals, sparingly soluble in water, and offering, at least apparently, every requisite evidence of purity.

The analyses I am about to describe were performed, for the sake of determining the proportions between the weight of the carbon and of the oxalate or the acetate, this weight being calculated in the state of carbonic acid, and the weight of the metal, in the state of green oxide of uranium. After numerous attempts, I was satisfied that this method is that which will more certainly lead to a correct result in experiments of this nature.

The apparatus I employed to determine this proportion, consists of a tube for the combustion, of white glass, and easily fusible, of from 25 to 30 centimetres in length, and drawn out to a point at each end; this tube received the salt intended to be burned.

This, by means of tubes of caoutchouc, is placed in communication, on one side with a reservoir filled with air, deprived of its carbonic acid and water, before arriving at the tube for combustion; on the other side, with a second and longer tube, filled with oxide of copper, and intended to convert the products of the salts to be analysed, into carbonic acid. The employment of this tube is indispensable, even in the case of oxalate of uranium, for I have proved that, contrary to what is written in treatises on chemistry, the gas that results from the decomposition of this salt, by means of heat, is not pure carbonic acid, but that it consists of a mixture of the latter substance with a small quantity of oxide of carbon, consequently we do not obtain by this process protoxide of uranium, as it was imagined, according to M. Berzelius, but an oxide of black colour, the composition of which much resembles that of *pechblende*. Its composition may, also, vary according to the mode of operating; the oxides of uranium being changed by the oxide of carbon into the state of protoxide (the ancient urania.)

At the end of a tube filled with oxide of copper, and placed, like the preceding, on a horizontal lattice of iron wire are placed—

1. A tube bent like the letter U, intended to receive the water; one of the arms of this tube is filled with chloride of calcium, the other with fragments of pumicestone, impregnated with concentrated sulphuric acid.

2. A second tube, of the same form, containing also a mixture of pumicestone and sulphuric acid, which is intended to answer the purpose of an indicator; this tube ought to remain of the same weight, during the operation, it answers the purpose of proving the perfect desiccation of the gas that passes through it.

3. Liebig's ball apparatus, containing a concentrated solution of caustic potash; this is intended to absorb the carbonic acid.

4. A letter U tube, containing, on one side, pumicestone, impregnated with a solution of potash, and on the other, solid potash. The office of this tube is to absorb the water and carbonic acid the gases coming from the preceding apparatus may still contain.

This apparatus is based on the same principles as those of Prout and Brunner, for analysing organic matters; it is analogous in its general arrangement, to that employed by M. Favre to determine the equivalent of zinc.

The quantities of salt on which I operated in the experiments I am about to record, varied from 4 to 12 grammes.

The mode of analysis I resorted to combined several conditions, which appeared to me extremely favourable for the determination, always so delicate, of atomic weights. It enables you to operate upon a weight of matter sufficiently considerable to reduce, to a great extent, the errors arising from the balance, and the weighing of the substance to be analysed; its object is to discover a simple proportion between the weight of a body, whose equivalent is, as we believe, irrevocably, in a certain way, fixed—carbonic acid and an oxide of uranium of a well-known composition, green oxide of uranium: it does not oblige one to keep an account of the greater or less degree of dryness, or moisture of the substance to be analysed, it being useless to know the weight of the latter. I consider this point as extremely important, and offering one of the most serious difficulties to be surmounted in these kinds of experiments; finally, it produces oxide of uranium in a medium, in which it cannot undergo any change; because this

* A note, having reference to this paper, will be found at page 54 of the present volume.

oxide, produced by the agency of the atmospheric oxygen, is weighed in a tube filled with air. When we determine the quantity of uranium, in the state of protoxide of uranium, the substance being obtained by reducing a superior oxide of this metal, by means of hydrogen, we have a difficult correction to make, if the tube remains full of this gas, or rather, we need fear a partial re-oxidation of the protoxide, if we replace the hydrogen by air, even when the tube is perfectly cooled.

This process, which can be employed to great advantage in the analysis of the greater number of the organic salts, has enabled me to ascertain that the preparation of oxalate of uranium, in a pure state, offers difficulties I did not expect, and to which I hesitate not to call the particular attention of chemists; these difficulties are of such a nature, that we must take them particularly into account, in the preparation of all the substances which enable us to determine equivalents.

I have no need to say that the salt of uranium I employed, to obtain the oxalate by a double decomposition, contained no foreign metal. In order to operate under such conditions as appeared to me best adapted to prepare this salt in a state of purity, I took solutions made at the ordinary temperature, and not saturated with nitrate or chloride of uranium and oxalic acid; I mixed them while hot. The oxalate of uranium, which crystallised as the liquid became cold, was first washed, by decantation with warm water, then thrown on a filter previously washed with nitric acid, and it was afterwards dried at the ordinary temperature. We know that in this state the oxalate has the following composition:—

$$C^2\,O^3,\ U^2\,O^3,\ 3\,H\,O,$$

and that it loses two of the equivalents of water when dried at 248° F.

Prepared in this manner, the salt was not in a state of purity, according to the result of the following analyses.

The combustion of the salt, performed in the apparatus I have previously described, gave the following results:—

	I.	II.	III.	IV.
	gr.	gr.	gr.	gr.
Carbonic acid ..	1·879	1·090	0·822	1·272
Green oxide of uranium	5·900	3·432	2·914	3·996

From these experiments we deduce the atomic weight of the green oxide of uranium, by means of the following proportions:—

$$n : 550 = n' : x.$$

n represents the weight of the carbonic acid furnished by the experiment; n', that of the uranium; x, the atomic weight of the oxide; 550 represents the weight of the carbonic acid ($C^2\,O^4 = 150 + 400$,) furnished by the combustion of one equivalent of oxalic acid, $C^2\,O^3$.

The following numbers express the atomic weights of the green oxide of uranium, and of uranium, deduced from the preceding experiments:—

	I.	II.	III.	IV.
Green ox. ($U^3\,O^{8\frac{1}{2}}$)	1·726	1·731	1·738	1·728
Uranium (U)	·730	·732	·735	·730

These numbers being considerably lower than those obtained by M. Ebelman, M. Wertheim, and myself; it was necessary to discover the cause of these deviations. They must have arisen either from the mode of analysis or from the nature of the salt.

The mode of analysis put into practice with the precautions I have pointed out in my memoir, seemed to offer conditions of correctness, so much the more real, as the differences were deduced, not from a deficiency, but from the excess of carbonic acid furnished by the combustion of oxalate of uranium.

As to the purity of the salt, there appeared to be nothing left to desire: according to the manner in which it was prepared, the repeated washings guarded against an excess, either of oxalic acid, or nitrate of uranium; the most delicate tests, also, did not enable us to detect the presence of nitric acid.

Fearing, however, that these tests were insufficient, and suspecting, in the first instance, the real cause of the variations between our former analyses and the present, I prepared a fresh quantity of the oxalate, not by means of nitrate of uranium, but with the chloride and oxalic acid. After repeated washings, it was easy for me to prove that this oxalate contained not the smallest trace of chlorine.

Its analysis gave—

	gr.
Carbonic acid.....	1·061
Green oxide of uranium....	3·276

from which we deduce the number 715, as the atomic weight of uranium.

This salt evidently contained an excess of oxalic acid, which was equivalent, in the preceding analysis, to from 30 to 40 milligrammes of carbonic acid. Dissolved in boiling water, and consequently purified, it gave, by a fresh crystallisation—

	gr.	gr.
Carbonic acid	1·476	1·223
Green oxide of uranium	4·673	3·859

or rather, 1·741, and 1·735, as the equivalent of the oxide, 737 and 734 as that of the uranium.

The composition of this salt became, therefore, the same as that of the oxalate employed in the first four analyses.

I then returned to what remained of the latter salt, which I had prepared, as I have said, with nitrate of uranium; I saturated it with boiling water, and I analysed the salt deposited one day on the day after; after the liquid had become cold, I obtained—

	gr.
Carbonic acid.....	1·456
Green oxide of uranium....	4·649

being 1·756, as the atomic weight of the oxide, and 745, as that of the metal.

The remainder of the salt, thus purified by a fresh crystallisation, was dissolved a third time in boiling water, its analysis gave—

	gr.
Carbonic acid.....	1·369
Green oxide of uranium....	4·412

being 1·772, as the atomic weight of the green oxide, and 752, as that of the uranium.

Finally, this last salt, redissolved a fourth time in boiling water, gave, after being again crystallised—

	gr.
Carbonic acid.....	2·209
Green oxide of uranium....	7·084

being 1·764, as the atomic weight of the oxide, and 749, for that of the uranium.

These last analyses confirm, by as close an approximation as possible, the number 750, which I formerly proposed as the representative of the atomic weight of uranium.

Still, fearing that the result had been obtained by a happy concurrence of circumstances, I three times crystallised that portion which remained of the oxalate, obtained by means of oxalic acid and chloride of uranium, which salt had furnished the numbers 737 and 734. Its analysis gave—

	I.	II.
	gr.	gr.
Carbonic acid	1·019	1·069
Green oxide of uranium	3·279	3·447

being from 1·769, to 1·773, as the atomic weight of the oxide, and from 751 to 753, as that of the metal.

In fine, as it clearly results from these analyses, that by beginning with an oxalate which appeared, at the outset, to offer sufficient guarantees of purity, we succeed in obtaining, by successively dissolving and crystallising it, a salt, containing a decidedly smaller quantity of oxalic acid than that it possessed in the first instance; it was necessary I should ask myself, whether there was a limit to this change in composition, and which is the salt that can be considered as absolutely pure; in fact, we might fear that by being repeatedly dissolved, in considerable quantities of water, the oxalate of uranium might be more or less changed, and become basic.

To solve this question, which is so much the more important, because, in the case of the affirmative, it probably affects all salts, which like that we are now considering are but sparingly soluble in water. I twice more dissolved and recrystallised all that remained of the oxalate, I employed in the last analyses; after having undergone six crystallisations, this salt gave—

	gr.
Carbonic acid	1·052
Green oxide of uranium ..	1·389

being, 1·770, as the atomic weight of the oxide, and 751, as that of the uranium.

This analysis shows, that the composition of this salt remains unaltered, when once it has attained a state of purity.

By taking the mean of the last six experiments, we have 750, as the atomic weight of uranium.

By omitting the analysis which offered the greatest difference, 745, and taking the mean of the other five, we obtain 751.

I have, in addition to this, made several new analyses of acetate of uranium, by endeavouring to estimate correctly the oxide in the state of green oxide: I obtained the following results:—

	I.	II.	III.	IV.	V.	VI.	VII.
Weight of acetate of uranium ..	5·061	4·601	1·869	3·817	10·182	4·393	2·868
Weight of the green oxide	3·354	3·057	1·238	2·541	6·757	2·920	1·897

These numbers give for the yellow oxide, $U^2 O^3$, contained in the acetate,

I.	II.	III.	IV.	V.	VI.	VII.
67·54	67·68	67·51	67·84	67·63	67·74	67·44

The mean of these experiment is 67·65.

I found for carbon and water—

Carbon.....	11·27	11·30	11·30	11·1
Water	21·60	21·16	21·10	21·2

Therefore taking 1800, as the equivalent of the yellow oxide (750+750+300) this salt contains 11·26 carbon, 21·09 water, and 67·65 yellow oxide.

So that, seeking for the proportion between this oxide and carbon, we obtain, either the number 750, by taking 11·27, or the number 747, by taking 11·30.

By resorting to the means furnished by the determination of the oxide, which appears to be the most strictly correct, the acetic acid being estimated by the difference, we

obtain exactly 750, as the atomic weight of uranium.

This number, which is the multiple of the atomic weight of hydrogen by 60, is also obtained by the analyses of oxalate of uranium; it appears that it ought to be definitively adopted as the atomic weight of this metal.

This number, which is nearly the same as that of M. Wertheim, is, it is true, higher than that obtained by M. Ebelman, in the numerous analyses of oxalate of uranium, made by that able chemist. But M. Ebelman could not forsee the difficulties I met with to obtain this body in a state of purity, he did not subject the salt he analysed to those multiplied crystallisations, which, alone, according to the facts I have noticed, could lead to the constant proportions of oxalic acid and oxide of uranium that testify its purity.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

OBSERVATIONS ON THE MORE RECENT RESEARCHES, CONCERNING THE OPERATIONS OF THE BLAST FURNACE IN THE MANUFACTURE OF IRON.*

BY DR. J. L. SMITH.

The great difference existing between metallurgical operations of the present day, and those of a former period, is owing chiefly to the ameliorations produced by the application of the science of chemistry to the *modus operandi* of the various changes taking place during the operations, from their commencement to their termination.

Copper and some other metals are now made to assume forms in the chemist's laboratory, that formerly required great artistical skill for their production, the chemist simply making use of such agents and forces as are at his command, and over which he has, by close analytical study, acquired perfect control. Our object, at present, is only to advert to the chemical investigations more recently made in the manufacture of iron, treating of those changes that occur in the ore, coal, and flux, that are thrown in at the mouth of the furnace, and in the air thrown in from below. For most that will be said on this subject, we are principally indebted to the recent interesting researches of M. Ebelman.

The importance of a knowledge of the facts to be brought forward in this article, will be apparent to every one, in any way acquainted with the manufacture of iron. It will be seen, that the time is not far distant when the economy in the article of fuel will amount in value to the present profit of many of the works. The consequence must be, that many of those works that are abandoned will be resumed, and others erected in localities formerly thought unfit.

It is well known that the blast furnace is the first into which the ore is introduced, for the purpose of converting it into malleable iron, and much, therefore, depends upon the state in which the pig metal passes from this furnace, whether subsequent operations will furnish an iron of the first quality or not.

In putting the blast furnace into operation, the first step is to heat it for some time with coal only. After the furnace has arrived at a proper temperature, ore, fuel, and flux are thrown in alternately, in small quantities, so as to have the three ingredients properly mixed in their descent. In from 25 to 48 hours, from the time when the ore is first thrown in, the entire capacity of the furnace, from the tuyer to the mouth, is occupied with the ore, fuel, and flux, in their various stages of transformation.

In order to explain clearly, and in as short a space as possible, what these transformations are, and how they are brought about, we may consider—

1. The changes that take place in the descending mass, composed of ore, fuel, and flux.

2. The changes that take place in the ascending mass, composed of air and its hygrometric moisture, thrown in at the tuyer.

3. The chemical action going on between the ascending and descending masses.

4. The composition of the gases in various parts of the furnace during its operation.

5. The causes that render necessary the great heat of the blast furnace.

* *Silliman's Journal.*

I. CHANGES THAT TAKE PLACE IN THE DESCENDING MASS, COMPOSED OF ORE, COAL, AND FLUX.

By coal, is here meant charcoal; when any other species of fuel is alluded to, it will be specified. In the upper half of the fire-room, the materials are subjected to a comparatively low temperature, and they lose only the moisture, volatile matter, hydrogen, and carbonic acid, that they may contain; this change taking place principally in the lower part of the upper half of the fire-room.

In the lower half of the fire-room, the ore is the only material that undergoes a change, it being converted wholly or in part into iron or magnetic oxide of iron; the coal is not altered, no consumption of it taking place from the mouth down to the commencement of the boshes.

From the commencement of the boshes down to the tuyer, the reduction of the ore is completed. Very little of the coal is consumed between the boshes and in the upper part of the hearth; the principal consumption of it taking place in the immediate neighbourhood of the tuyer.

The fusion of the iron and slag occurs at a short distance above the tuyer, and it is in the hearth of the furnace that the iron combines with a portion of the coal to form the fusible carburet or pig-iron. It is also on the hearth that the flux combines with the siliceous and other impurities of the ore. This concludes the changes which the ore, coal, and flux undergo from the mouth of the furnace to the tuyer.

If the fuel used be wood, or partly wood, it is during its passage through the upper half of the fire-room that its volatile parts are lost, and it becomes converted into charcoal. M. Ebelman ascertained that wood, at the depth of 10 feet, in a fire-room 26 feet high, preserved its appearance after an exposure for 1¾ of an hour, and that the mineral mixed with it preserved its moisture at this depth; but three and a half feet lower, an expoure of 3½ hours reduced the wood to perfect charcoal, and the ore to magnetic oxide. The temperature of the upper half of the fire-room, when wood is used, is lower than in the case of charcoal, from the great amount of heat made latent by the vapour arising from the wood. In the case of bituminous coal, Bunsen and Playfair find that it has to descend still lower before it is perfectly coked.

After the wood is completely charred, or the coal become coked, the subsequent changes are the same that happen in the charcoal furnaces.

II. CHANGES THAT TAKE PLACE IN THE ASCENDING MASS, WHICH IS COMPOSED OF AIR AND HYGROMETRIC MOISTURE.

The weight of the air thrown in at the tuyer in 24 hours is twice that of the ore, coal, and flux thrown in at the mouth during the same time.

The air, as soon as it enters the tuyer and reaches the first portion of coal, undergoes a change—its oxygen is converted into carbonic acid, and its moisture decomposed, furnishing hydrogen and carbonic oxide; after ascending a short distance (12 or 18 inches), the carbonic acid is converted into carbonic oxide; between this point and the upper part of the boshes it undergoes but very little change, having added to it a further small amount of carbonic oxide. So that the ascending column at the top of the boshes is composed of nitrogen, carbonic oxide, and hydrogen; from this point it begins to undergo a change; the carbonic oxide diminishes, carbonic acid appears, and goes on increasing for about half the way up the fire-room; after which the carbonic acid, carbonic oxide, and nitrogen remain the same, when the hydrogen increases, and moisture begins to appear and augment up to the mouth. The ascending mass, as it passes out of the mouth, contains the vapour of water, carbonic acid, carbonic oxide, hydrogen, and nitrogen. The nitrogen undergoes no alteration in its passage through the furnace, and the same is true of the hydrogen formed at the tuyer.

If wood be used, the gases passing out of the mouth are the same as those just mentioned, with an increased quantity of moisture, and the addition of those pyroligneous products arising from the dry distillation of wood.

In case of the use of bituminous coal, the gases, first alluded to, have added to them ammonia, light carburetted hydrogen, olefiant gas, carburetted hydrogen of unknown composition, and sulphuretted hydrogen.

III. THE CHEMICAL REACTION OCCURRING BETWEEN THE ASCENDING AND DESCENDING MASSES.

From the foregoing statements, we can at a glance see what are the materials to be met with in the different parts of the furnace, and can therefore readily study their reactions upon each other.

In the upper half of the fire-room, little or no chemical action is taking place, the ore, flux, and coal, as already stated, simply losing their volatile parts. In the bottom of the upper half, and the entire lower half of the fire-room, a reaction is taking place be-

tween the ore and the carbonic oxide of the ascending column; iron or magnetic oxide of iron and carbonic acid being the result. It must be borne in mind, that the coal has played no part in this reduction down to the commencement of the boshes. Between the boshes, and in the hearth, no reaction appears to take place between the ascending and descending masses, but the reduction of the ore is completed by the direct action of the coal upon the remaining portion of the undecomposed ore, carbonic oxide being formed; and here is the first consumption of the coal, in its passage downwards.

According to M. Ebelman, the ore loses in the fire-room $\frac{4}{28}$ of its oxygen by the reaction of the oxide of carbon, and the remaining $\frac{4}{28}$ disappears in the boshes and hearth, in the manner already stated, at the expense of from $\frac{6}{100}$ to $\frac{1}{100}$, of the entire amount of charcoal used.

The ore being now completely reduced, unites with a portion of carbon in the hearth, melts at about 13 inches from the tuyer, and descends into the crucible; and here also the flux, combining with the impurities of the ore forms the slag, which melts.

The coal and the air react upon each other most powerfully just in the neighbourhood of the tuyer, where the most intense heat is produced; the oxygen becomes converted into carbonic acid, which, acting upon a portion of the ignited coal, is almost at the same moment reduced to carbonic oxide; the moisture of air acting on the ignited charcoal undergoes the decomposition already mentioned, hydrogen and carbonic oxide resulting therefrom.

When the ore is easy of reduction, the gas at the boshes is represented by 100 nitrogen and 52·5 carbonic oxide, plus the quantity of carbonic oxide and hydrogen afforded by the moisture.

It must be clearly understood, that these rules do not apply to every variety of ore. They are especially applicable to the hematites and such ores as are either naturally porous or become so in their passage through the fire-room of the furnace, thus increasing the surface of contact exposed to the action of the reducing agent (carbonic oxide), so that when it has reached the boshes the reduction is nearly complete.

The specular, magnetic, and siliceous ores are reduced with much more difficulty; most of the ore, in these cases, reaching the boshes but slightly altered, they being principally dependant upon the direct action of coal for their reduction. This circumstance largely increases the consumption of coal when any of these ores are employed; and the amount of caloric made latent, in consequence of the reduction requiring the direct action of the coal, is very great; whereas in the reduction of the ore by carbonic oxide no heat becomes latent, for the heat rendered latent by the oxygen of the ore becoming gaseous, is compensated by the sensible heat produced by the combination of the carbonic oxide with the oxygen. Where the reduction is produced by the carbon, with the formation of carbonic oxide, 1598 unities of heat are made sensible, while 6216 are rendered latent, giving a difference of absolute loss of 4618.

It should be the object of the metallurgist to reduce as much of the iron as possible by the oxide of carbon. Magnetic, siliceous, and other hard ores, should be reduced to smaller fragments than those softer and more easily managed. Were it possibe to reduce them to powder without the danger of choking the furnace, it would be all the better, as the great object is to have a large extent of surface exposed to the carbonic oxide. The different capacity of different ores for reduction shows the necessity of having furnaces of different dimensions for them respectively.

The matter which covers the melted metal in the crucible, and that which adheres to the interior of the hearth, contains silicate of iron and charcoal in a pasty state, and there is, consequently, a constant reduction of the oxide of iron, which gives rise to carbonic oxide; this gas bubbles through the slag, which, if drawn off at this time, will, when cold, present a porous structure — a sure indication that the furnace is not working well, and that the slag itself contains much of the ore in the form of a silicate.

IV. COMPOSITION OF THE GAS IN VARIOUS PARTS OF THE FURNACE DURING ITS OPERATION.

The analyses lately made by Ebelman are the most accurate and best detailed that we are in possession of. What follows has reference to a furnace worked with charcoal.

Gas taken from the mouth of the furnace and dried:—

Carbonic acid	12·88
Carbonic oxide	23·51
Hydrogen	5·82
Nitrogen	57·79

The vapour of water in a hundred volumes of this gas, varies from nine to fourteen volumes. Examinations made at different times show the proportion of hydrogen and nitrogen to be nearly uniform, and that the sum of the volumes of carbonic acid and carbonic oxide is constant, but that there is a variation in their respective proportions.

Gas taken from the interior of the fire-room at 5 to 10, and 13 to 17 feet from the

mouth (fire-room 86 feet). From five to ten feet the proportion of moisture diminishes, the other ingredients remaining about the same. From thirteen to seventeen feet the proportion of carbonic oxide increases, while the carbonic acid and hydrogen diminish.

Gas from the bottom of the fire-room and top of the boshes. This is remarkable for the constancy of its composition, and for the absence of carbonic acid and watery vapour. Composition :—

Carbonic oxide	35·01
Hydrogen	1·92
Nitrogen	63·07

Gas from the bottom of the boshes and commencement of the hearth :—

Carbonic acid	0·31
Carbonic oxide	41·59
Hydrogen	1·42
Nitrogen	56·68

Gas from the neighbourhood of the tuyer :—

Carbonic oxide	51·35
Hydrogen	1·25
Nitrogen	47·40

The two last statements would appear to contradict the rules previously laid down, as regulating the operation of the blast furnace; for, according to them, the proportion of carbonic oxide, at the top of the boshes, should be a little greater than in the hearth, whereas the reverse would appear to be the case by the analyses here given. Besides, from a glance at the composition of the three last gases alluded to, it would appear that the gaseous products, as they ascended the furnace, lost completely, a portion of the carbonic oxide, without a replacement by carbonic acid or other compound; in other words, a portion of it would appear to be completely annihilated, which of course is an impossibility. This apparent anomaly is easily accounted for, when it is stated how the gas was collected.

In order to obtain the gas from different portions of the furnace, holes were bored into the side, and a tube inserted, by which it was drawn off. Allusion has already been made to the fact that a pasty mass adheres to the sides of the hearth, containing silicate of iron and charcoal, in which there is a constant reduction of the iron, with the formation of carbonic oxide. Now it is evident that the gas drawn off by a hole bored into the side of the hearth will be largely mixed with this carbonic oxide forming in the immediate neighbourhood of the opening, and that it cannot serve as an index to the character of gas passing through the centre of the hearth. M. Ebelman was aware of this fact, but he was not able to overcome the difficulties in the way of obtaining the gas under the proper circumstances.

Gas taken at the tuyer. Here it is little else than atmosphere mixed with a few per cent. of carbonic acid.

From these results it would not be difficult to admit, that the oxygen of the air is converted immediately into carbonic acid, which is rapidly changed into carbonic oxide, under the influence of an excess of carbon and the high temperature developed near the tuyer.

V. THE CAUSES THAT RENDER NECESSARY THE GREAT HEAT OF THE BLAST FURNACE.

The weight of the ore, flux, and combustible, which enters the furnace, being only one half that of the ascending column, and as the specific heat of these three materials is very much below that of the gas of the ascending mass, it is not the heating of them that explains the necessity of the very great heat of the blast furnace. But the principal cooling causes are,—

1. The drying of the ore, flux, and coal, and the expulsion of carbonic acid from the flux, &c., rendering much of the heat latent; for what was solid is now transformed to the gaseous state.

2. The reduction of the ore, or in other words, the transformation of the solid oxygen of the ore into gaseous oxygen. If the ore has been deprived of its oxygen by the action of carbonic oxide, with the formation of carbonic acid, the heat rendered latent by the oxygen, is compensated for by the heat developed by the reaction between the oxygen and carbonic oxide; which is the character of the operation that principally takes place in the lower part of the fire-room. If the ore has been deprived of its oxygen by the direct action of the coal, the amount of heat rendered latent is enormous, as already stated; for carbonic oxide is the result of this reaction, and the amount of heat developed by it falls far short of that rendered latent by the oxygen that has entered into its formation, assuming the gaseous condition—this is the character of the reduction taking place in the boshes and hearth.

3. The conversion of the carbonic acid near the tuyer into carbonic oxide has a powerful influence in cooling the upper part of the hearth; for of the 6260 units of heat formed by the first action of the air upon the coal, 4662 are rendered latent by the conversion of this carbonic acid into carbonic oxide.

This terminates what it was proposed to treat of; it is little else than a sketch of the chemistry of the blast furnace, sufficient to show its importance.

In a future article, some remarks will be made upon the amount of combustible lost in the operation of this furnace, the recent methods employed to prevent this loss in the complete combustion of coal, the action of the hot blast, theory of the refining furnace, charring of wood, and other points of interest.

ON CERTAIN IMPROVEMENTS IN BLEACHING YARNS AND FABRICS.*

BY MR. R. SIMPSON.

This invention of improvements in bleaching yarns and fabrics consists in the employment of certain solvents, by which the yarns or fabrics of linen are to be prepared for bleaching, before the ordinary means or processes of bleaching are resorted to. These solvents are to be applied to the yarns or fabrics of linen in a preparatory process of boiling, prior to the goods being immersed in the ordinary bleaching materials.

The solvents to be employed, are either simple acids, followed by solutions of soda-ash, or acids, combined with soda-ash, in which the yarns or fabrics of linen are to be boiled for a space of time to be regulated according to circumstances, and the application may be varied according to the character or condition of the material to be acted upon.

A composition of solvents which has been found to answer for this purpose, is made by 22 lbs. of sulphuric acid of the first quality and strength, diluted in 50 gallons of pure water, which are to be boiled together in a leaden vessel, and, whilst boiling, 1 cwt. of of the best soda-ash is to be introduced into the liquor, by very small quantities at a time. The effervescence having ceased, the mixture must be kept boiling until the soda-ash is quite dissolved; and then, the sediment having been allowed to subside, the liquor may be drawn off quite clear, in which state it will be fit for use; but, if desired, the liquor may be evaporated, and its essential properties crystallised into the state of salt.

When the solvent material is prepared for acting upon cloth or particular kinds of yarns, it may be desirable to render it caustic, which is done by adding to the above compound about half a hundred-weight of lime, and an equal quantity of potash.

As cloths and yarns vary in quality, the patentee has thought it desirable to describe two or three ways (which have been found successful) of applying this material.

1. For 10 cwt. of yarns, take 20 gallons of the prepared solvent liquor, and boil it in a sufficient quantity of water; when cold, throw in the yarns, and allow them to steep in the liquor for about 12 hours; then, after washing in clean water and squeezing the yarns, throw them into a tub of sours, prepared with about two parts of vitriol to 98 of water; let the yarns remain five or six hours in this solution, and then wash them in pure water and squeeze them, when the yarns will be ready for the usual process of bleaching.

2. For 10 cwt. of yarns, take 20 gallons of the prepared liquor; throw in the yarns, and boil them in it for two or three hours; then wash and squeeze, and proceed with the sours as usual.

3. When the yarn is very inferior in quality, after submitting it to the first described process, boil it two hours in a weak solution of soda-ash, with a sufficient quantity of water.

4. Instead of using the prepared liquor, steep the yarns for five hours in warm water (at about 68° Fahr.), in which water, about two parts by measure of vitriol to 98 of water has been previously mixed; then wash and squeeze the yarns, and afterwards boil them for two hours in a weak solution of soda-ash.

5. For cloth and other fabrics, the caustic preparation may be desirable, in which lime has been incorporated as above described.

With these instructions, it is considered that an experienced bleacher will be enabled to vary the proportions of materials, and the time of boiling, according to circumstances, arising out of the quality of the goods to be operated upon.

In the preparation of cloths for bleaching, a mechanical contrivance may be desirable, by which the cloths shall be conducted by a series of small rollers, set in a pan or trough, filled with the caustic liquor above described, kept constantly boiling. Upon the machine a pair of squeezing-rollers should be mounted, between which the cloth may be made to pass, and then enter a second pan or vat, and in like manner be conducted, by a series of rollers, through a solution of soda-ash, kept boiling; and, after again being squeezed by rollers, the cloth may be wound upon a portable beam-roller, ready to be taken to the bleaching apparatus.

The patentee does not, however, consider any of these machines to be new, but limits his claim of invention to the processes of preparing yarns and fabrics of linen for bleaching, as above described.

* *Newton's Repertory of Arts, &c.*

EXTRACT FROM THE FIRST ESSAY ON THE COMPOSITION AND STRUCTURE OF SEVERAL OF THE ORGANIC PARTS OF PLANTS.*

BY MESSRS. MIRBEL AND PAYEN.

The experiments of which an account is given in this and the succeeding essay, were made three years since; but the result was not laid before the Academy until March last; the delay being occasioned by the preparation of a series of elaborate drawings, by which the subject was illustrated.

The first memoir of the authors treats of the elementary composition of vegetables, and demonstrates, by numerous chemical analyses, that the younger the organs of plants are, and the more ready to develop themselves, the greater is the amount of nitrated substances that penetrate and vivify them.

In studying in this first memoir the modifications of organism submitted to our examination, we shall soon obtain a proof that there exists, in fact, certain connexions between the agents possessing a certain chemical composition and the different states of their development. Still, it was requisite to ascertain if the law was general, or if it allowed of exceptions. To answer this question correctly, it was necessary to multiply the divisions of the various organisms, in such a manner that there should be, as it were, no interval between them; and the results we have obtained are such that we must conclude, if there are exceptions, they are extremely rare. But our labours were not confined to this point. It was also necessary to determine, by the methods chemistry placed at our disposal, the amount of nitrated substances, whether small or large, in those portions of plants where new tissues made their appearance. An account of all the precautions we took to attain this object, will be found in our memoir.

The following are the objects we selected, for the purpose of submitting them to elementary analysis:—

1. Young roots, on the different parts of which we have proved the influence of age, particularly in connexion with the proportion of nitrated or quaternary substances: and we have compared, bearing this point in view, the products of cultivation in poor and highly manured ground.

2. The stem of an oak in full vigour, twenty-five years of age, and, consequently, sufficiently old to exhibit, in a single section, perpendicular to its axis, a certain number of concentric layers of different ages in the heart of oak, the sapwood, and the cortical layers.

3. Branches more or less developed, which we also studied, either by concentric zones, or by successive sproutings, exhibiting several stages of development.

4. The epidermis, collected at different ages, distinguishing also the composition of the cuticle from that of the subjacent epidermic layers.

5. Leaves gathered at certain stages of their vegetation, or separated into various parts, also, for the purpose of ascertaining the influence of age on the elementary composition.

6. The organs of fructification.

7. Fractional organisms, following the same plan, and selected from among cryptogamous vegetables.

We have collected into a synoptical table the numbers of the analyses, and the results showing the proportions of water, mineral matters and nitrogen, in the substance, whether in a normal state, or dried; and, in the organic matter, the comparative proportion of the nitrated substance in comparison with the total weight of organised matter.

By consulting this table we shall see, that in every case the same conclusion is arrived at; that even striking differences of elementary composition, and always in the same direction, have exhibited themselves, in successive shoots of the same nature, in which the development of some has only preceded that of others by from twenty to thirty days.

EXTRACT FROM THE SECOND MEMOIR.

What we have said in the preceding memoir, will not allow us to doubt that the younger the vegetable tissues are, the more nitrated matters they contain, and the greater their power of development, although at certain periods their growth is stopped, or becomes extremely slow. But, in proportion as these different organisms grow old, the nitrated substance is withdrawn, and replaced by cellulose, either pure, or mingled with woody substances containing no nitrogen among their constituent parts. Then the cellulose, secreted in the cavities of the tissues, thickens their parietes and solidifies them. What proves that matters pass in this manner may also be shown by the bud and its developments.

Let us admit that the bud, looking at its size, has only been produced a short time since; it contains a remarkable quantity of a nitrated substance in its upper part, that portion being the youngest, while the lower part of the same bud, being older, has lost part of its nitrated matter, which has given

* *Comptes Rendus*, March 30, 1846.

place to cellulose and woody principles. From hence it results, that this lower portion thickens, becomes lengthened, and lifts up the upper portion. This shows us how it occurs that the bud-stalks of the stems, and the branches are developed in succession; beginning at the base, and proceeding towards the summit. It remains to be discovered what becomes of the nitrogen, whose proportions are diminished. Does it return to the soil, or to the atmosphere, from whence it came? Or do the compound bodies that reckon it as part of their elements, carry it to the assistance of the newly formed organisms? The last conjecture is the most probable: it is supported by observations resulting from chemical analysis, and it attracts our attention to an important distinction between substances contained in the same fluid, but some of which, of a ternary composition, are condensed to form little cysts (utricules), the sides of which are extremely thin, or else to thicken and strengthen more perfectly developed cysts.

To understand the true value of the preceding observations, we think the close consideration of a particular fact will not appear out of place here. Several years back we selected a young and well formed bud on a horse-chesnut tree, which was beginning to develop itself, not at its summit, but at its base; it became lengthened, thickened, and produced a bud-stalk. When this bud-stalk had attained the length of nine centimetres, we considered it right to divide it, in imagination, into three equal parts, each measuring three centimetres; this was easily done by fixing the points of two small pins in the bark of the bud-stalk, one three centimetres above the base, and the other three centimetres below the base of the upper bud-stalk. We say of the upper bud-stalk, because, while that was being developed, a second sprouted out between it and the bud, and others would be formed at a later period.

But let us return to our first bud-stalk; we cut it longitudinally into two equal parts, and, as we had a right to expect, we were not long in perceiving that the thickening was caused by the formation of utricular layers, placed over each other, which had less consistence as they approached the base of the upper bud-stalk, that was about to be developed like the preceding. But it may be said, from whence arises this gradual thickening of the utricular layers? To this question chemical analysis answers by irrefutable facts, the younger the tissues are the less woody and cellulose substance do they contain. It, follows, therefore, that in any given bud-stalk the lower tissues, which are evidently the oldest, first pass into the ligneous state, while the superior tissues, of quite recent formation, and which necessarily are growing in the direction of the summit of the bud-stalk and the base of the leaves, have not as yet had time to transform themselves into wood.

De Lahire, a learned Academician, of the sixteenth century, imagined that the woody layers of dicotyledonous plants commenced at the base of the bud, and descended to the neck of the roots. This mode of viewing the case was not justified by any positive fact; yet this did not prevent, at a later day, the learned Du Petit-Thouars adopting Lahire's doctrine; but he endeavoured in vain to bring it into repute. He observed, that when we graft a bud on a tree, it sometimes happens that the base of the bud produces filaments, which are directed towards the earth; and as they are only seen to descend the distance of a few centimetres, his ardent imagination suggested the idea, that these fibres were produced and increased by an organising power which, like electricity and light, appears to be ignorant of distance; these are the words of Du Petit-Thouars. But we scarcely believe, that, at present, any phytologist would be contented with this explanation. There is every evidence that the filaments springing from the base of a bud are true rootlets. It is sometimes sufficient merely to place the bud upon somewhat moist light earth, to cause it to take root and produce a plant of its own species.

The following is a fact not less worthy of attention:—we choose a healthy leaf attached to a tree, and by means of a needle and thread we pass a ligature round one of the most prominent veins, *nervures*. A short time afterwards we shall perceive that a palpable thickening has taken place above the ligature. But to what cause are we to attribute this thickening, if it be not the tendency of the nutritive matter to seek the base of the vegetable? We have a proof of this in dicotyledonous trees. A strong ligature passed round a stem or branch, will soon cause a large ridge to appear, while if, on the contrary, we allow the tree to grow freely, the organising matter, in one word the cambium, will be deposited between the bark and the wood, beginning at the young summits of the tree and ending at the neck of the root, and at that point the lignification takes place. This takes an ascending course, and spreads by degrees to the very extremities of the branches. This in a large way, would be a repetition of what we have seen in miniature in the bud-stalk of the horse chesnut.

As yet, we have said nothing directly ap-

plicable to monocotyledonous trees. The difference between these and the dicotyledons, is great; the latter justly assume the first rank. Their internal organisation attracts notice at the first view, whether on account of the beautiful arrangement of their parts, or by the solidity of their whole structure. The internal organisation of the monocotyledons is very different. At first sight there appears to be nothing but disorder and confusion, but when we seriously study the work of nature, we soon perceive she has done nothing that is not worthy of our attention.

A vigorous bud expanding its large and beautiful leaves on the surface of the ground, is the origin of the stem of the date palm. As this bud increases in age, the lower leaves fall off, and, at the same time, new leaves spring from the axis of the upper part of the stem. These leaves, in their turn, increase in size, grow old, and fall off, and others succeed them, perfectly resembling the preceding. This state of things continues as long as the vegetation of the tree goes on, which is, in fact, merely a continuous bud, and which, consequently, has no bud-stalk. It is to be observed that the bases of all the leaves of the date palm touch and press upon each other, and when they are detached, each of them leaves a thick ridge, the surface of which is lozenge-shaped, and all these ridges, following each other, form a band in relief, which describes a spiral line, frequently broken by the falling off of the ridges.

It certainly is not by horizontal or transverse cuts that it is possible for us to obtain an intimate acquaintance with the progress and the functions of the filaments that run through the stem. But we must perceive that, in certain cases, such as those we are about to notice, a vertical cut may very well enlighten the observer; for example, in the stem of the date palm. By means of a sharp-cutting instrument we divide it throughout its whole length, into two equal parts, and by this operation we lay open to observation a bundle of filaments which ascend through the central part of the tree. It is evident that, in this case, the assistance of anatomy is perfectly useless. It only shows us that the filaments, generally speaking, are first formed in the internal periphery of the stem. But these threads are not long before they bury themselves in the mass of utricular tissues, and it is then the observer must have recourse to anatomy; to remove these tissues, and expose the filaments without injuring them, let them follow whatever varying directions they may; with patience, a little skill, and a scalpel, we obtain the following result:—

Amongst the innumerable filaments we have before our eyes, we distinguish one which seems to be more stoutly made than the rest, and which also, for certain reasons, we called the precursor filament. Originating at the internal periphery, this filament is first directed towards the centre of the tree, describing an ascending curve, and soon afterwards it becomes one of the central bundle. After this, when it has reached a certain height, it separates itself from the bundle, and glides horizontally across the utricular tissue, towards the internal periphery, which is placed, more or less, directly opposite the first point of departure of the precursor filament; the latter attaches itself to the base of a newly springing leaf, and a most remarkable thing occurs, all the small filaments, which, until then, had been dispersed, collect together, and proceed in a body to carry assistance to the young leaf.

We must be cautious not to imagine that what we have related occurs but once in the stem of the date palm, for it takes place afresh every time a new leaf is formed; and, as the leaves spring out on every side, and arrange themselves on the stem in symmetrical order, it necessarily follows that a general crossing of the precursor filaments occurs through the whole length of the tree.

As to the filaments, considered singly, we may observe, that they have a great affinity to the ligneous layers of the dicotyledons, if not in their form, at least in substance. As in the dicotyledons these filaments are converted into wood, beginning at the base of the tree, and the conversion into wood gradually becomes less perfect, as the filaments lengthen, for the purpose of attaching themselves to the leaves. This doctrine is certainly very different from that of Lahire and Du Petit-Thouars.

In fine, if the formation of the tissues and filaments began at the summit, and continued to the base of the tree, it is evident that their loftiest summits would be older than the lower portions. The first containing cellulose and woody matter, in larger proportions, from whence it would arise, that they would contain, relatively, less nitrated matter. But it is the contrary that always takes place, and we have proved it by numerous facts in our first paper. Thus chemical analysis agrees in every point with anatomy and careful research, in removing the errors of our predecessors' ideas.

After having deduced, from our first series of experiments, the consequences we have just noticed, we undertook fresh researches, in which the employment of tests could illustrate anatomical observation, and demon-

strate other effects of the development of vegetable organisation.

Seeing that ternary substances, composed of hydrogen, oxygen, and carbon, consolidate tissues, and show their age, it appeared to us that these substances must produce interesting changes in the structure of those parts, whose vitality is prolonged beyond the ordinary limits.

In the first place, with this intention, we examined leaves that remained after the autumnal fall, and, among the means of consolidation which the non-nitrated substances furnished by their accumulation, we discovered, in fact, sufficiently remarkable organs, namely—fibres of encrusted cellulose, extending their ramifications from one side of the leaf to the other, a kind of stays, keeping the epidermis separate, and having the semblance of protecting the parenchyma from the pressure of the thickened layers of the epidermis. In addition to this, numerous partitions, formed of cells with strong sides, and also traversing the parenchyma of the root in the same manner, producing an additional general consolidation, supported the vascular bundles of nervulæ.

We noticed arrangements of this nature, and, in addition, a marginal rim of thick injected cells, in the sections of the leaves of the camelia, olea fragrans, thea viridis, magnolia grandiflora, nerium oleander, holly, orange, box, &c.

We have discovered on the leaves of the rose-laurel, and traced under the microscope, the singular disposition of the stomatæ, at the bottom of distinct cavities, the entrances to which were irregularly circular, and protected by numerous recurved hairs.

An abundance of amylaceous globules, appears in the cells of the parenchyma, in the well developed leaves of the tea plant and the camelias.

In every part, where the thickening of the cells, and simple or ramificated fibres, takes place in the leaves rapidly, we observe little canals, in large numbers, traversing the sides, and forming a communication between the central cavity and the sinuous tissues or their canals.

These little canals also perforate the cells, injected and thickened by the particular principles of wood, in various kinds of nuts, and in grape seeds. We have observed analogous arrangements in the lanceolated fibres of cinchona bark, whether free, or united in bundles.*

The nuts of celtis exhibited a remarkable peculiarity in their composition; the thick sides of their cells are formed of cavernous cellulose, all the little cavities of which are filled with carbonate of lime; this salt, being exceedingly compact, gives a great degree of hardness to the whole of the nut.

In many leaves, and particularly in those of the beach, we have observed, and had drawings made of, the arrangement of the crystals of oxalate of lime in linear series, parallel to the veins of the leaves and their branches.

* These double-pointed, and extremely minute cortical fibres, fly about like dust when yellow bark is pounded; they are the cause of the serious inconveniences complained of by the workmen, by sticking in their skin.

* *Newton's Repertory.*

IMPROVEMENTS IN THE MANUFACTURE OF CHLORINE, IN TREATING SULPHUROUS ORES, AND OTHER MINERALS, AND IN OBTAINING VARIOUS PRODUCTS THEREFROM.*

BY MR. W. LONGMAID.

This invention relates to the manufacture of chlorine from iron pyrites or other sulphurous ores, common salt, and oxygen, and from various metallic chlorides and oxygen.

In decomposing common salt, by the joint action of iron pyrites or other sulphurous ores, oxygen, (obtained from atmospheric air) and heat, as described in the specifications of patents obtained by the present patentee, October 20, 1842, and January 4, 1844, the chlorine of the salt is disengaged, and combines with the metals contained in the ores, forming the chlorides of such metals; and the patentee has discovered that, by continuing the calcination, the metals of certain chlorides become oxidised with the evolution of chlorine. To obtain the chlorine thus disengaged, the mixture of ore and salt is calcined in an open furnace, as described in the first specification, until sulphuric acid ceases to be evolved; the charge is then withdrawn, and put into a close furnace (provided with apparatus for forcing in dry atmospheric air, and collecting the chlorine), in which the calcination is continued until the evolution of chlorine ceases: the relative proportions of ore and salt will depend upon the amount of sulphur in the ore; but the mixture must contain from 35 to 40 parts of sulphur to 100 parts of salt.

The patentee has also discovered that various metallic chlorides, such as those of iron and manganese, when heated in contact with dry atmospheric air, are decomposed, and chlorine is evolved, by the oxygen of the

air combining with the metals, and forming oxides of such metals.

When metallic oxides, particularly those of manganese, copper, zinc, and lead, are mixed with hydrochloric acid, the residual matters contain chlorides of such metals,—these the patentee proposes to dry and employ for obtaining chlorine, by oxidizing the metals of such chlorides with dry atmospheric air.

Dry atmospheric air must be used in all these cases, as otherwise the moisture usually contained in the air becomes decomposed, and the hydrogen of the water combining with a portion of the chlorine, forms hydrochloric acid.

The close furnace, above mentioned, is of a rectangular form, 20 feet long and seven feet wide in the clear; the chamber of the furnace is as nearly air-tight as possible, and there are doors in the sides for charging and stirring the charge; the flues from the fireplace are conducted over and under the chamber into a flue connected with a chimney. A rotary fan or blower is connected with the chamber of the furnace (termed the chlorine generator), for the purpose of forcing in air, which is distributed over the interior of the generator by a series of small tubes; the air having been previously deprived of moisture by passing through a chamber nearly filled with pieces of coke, or other suitable material, on which a layer of chloride of calcium is placed; when metallic chlorides are operated upon, the air-tubes are placed over the top of the generator, in order that the air may be heated before it enters the generator. The gases evolved pass from the generator through tubes or flues into a chlorine purifier, consisting of a flue, 40 feet long and one foot square, made of deal boards one inch thick; it is immersed in water, which, penetrating through, keeps the inner surface of the flue in a wet state; a waste-pipe being inserted at the further end, so that only a thin stratum of water may remain at the bottom of the flue. If, on putting a charge into the generator, sulphurous acid gas is found to come over, the communication with the purifier is shut off, and the vapours allowed to pass into the chimney, until sulphurous acid gas is no longer detected, and then the vapours are permitted to pass to the purifier. To condense any moisture, hydrochloric acid, or other matter that may be accidentally evolved from the generator, a leaden flue (nine inches in diameter) is applied to the end of the wooden flue, rising to the height of 10 feet, and then descending 10 feet. The end of this flue dips into water in an open cistern, and a branch-pipe proceeds from the lower part of the descending flue into the chamber wherein the chlorine is condensed or used for the ordinary purposes of manufacture. The chlorine thus obtained is mixed with an excess of atmospheric air, nitrogen, or other matters, which are allowed to escape through a leaden eduction pipe (two inches in diameter and 10 feet high) attached to the top of the condensing chamber.

The patentee claims—Firstly, the manufacture of chlorine by the calcination of a mixture of iron pyrites or other sulphurous ores and common salt, with access of atmospheric air deprived of moisture.

Secondly, the manufacture of chlorine by oxidizing metallic chlorides, such as manganese, copper, iron, zinc, and lead, by access of atmospheric air deprived of moisture, thereby producing chlorine and the oxides of such metals.

ON A METHOD OF ASCERTAINING THE QUANTITY OF GOLD AND SILVER CONSUMED IN ELECTRO-GILDING AND SILVERING.*

BY MAXIMILIAN, DUKE OF LEUCHTENBERG.

The objection of slight durability which has been made to articles gilt by the galvanic process, is principally owing to the circumstance, that only a very small quantity of gold is allowed to be deposited on the object to be coated. The determination of the amount of precipitated gold, by weighing the gilt object, is only applicable with small articles, as the scales are not sufficiently accurate for the larger objects. The author therefore advises determining the quantity of precipitated gold from the loss which the solution of chloride of gold employed experiences. For this purpose, a decilitre of the liquid is evaporated to dryness, the residue weighed, then two grms. of it heated with sulphuric acid, taking care however not to inhale any of the liberated prussic acid, and the heat finally carried to redness. The fused mass, consisting of gold, and sulphate of potash, is now carefully extracted with water, and the gold remaining in the crucible heated to redness and weighed. After gilding with the solution examined, a decilitre is submitted to the above described process, and from the difference in the amount of gold in the two liquids, the quantity of precipitated gold is ascertained.

In the process of silvering with the ordinary liquid, which consists of cyanide of silver, cyanide of potassium and chloride of

* *Journ. fur Prakt. Chem.*, and *Chem. Gazette.*

potassium, a decilitre is evaporated as above to dryness, and the residue weighed; two grms. of this are then heated to redness, when the cyanide of potassium, chloride of potassium, and carbonate of potash fuse, while the cyanide of silver is converted into paracyanide of silver, and is subsequently entirely reduced. After 15 to 20 minutes' ignition, the cold mass is exhausted with water, and the silver remains in the crucible as a spongy mass, so that none is washed away by the water; it is then heated to redness, and weighed. Clay crucibles cannot be employed in determining the silver, as their porous mass imbibes a portion of the fused salt, and so produces a loss in silver.

ON CERTAIN IMPROVEMENTS IN THE PRODUCTION OF COMBUSTIBLE GASES, AND THE APPLICATION OF THE SAME AS FUEL.*

BY MR. W. POLLARD.

THIS invention consists, firstly, in applying a blast of highly heated steam, in conjunction with atmospheric air, to convert solid fuel into combustible gases in appropriate furnaces, which gases are conveyed away by suitable flues or pipes to any place where they may be required to be burned; and, secondly, in burning the said combustible gases with a blast of hot air, to produce heat for all purposes for which solid fuel has hitherto been employed.

The patentee remarks, that he is aware carbonic oxide gas has been frequently employed as fuel, but by his invention the mixture of carbonic oxide and hydrogen (obtained by a combined blast of highly heated steam and atmospheric air, acting on ignited fuel in excess as aforesaid), will consist, as nearly as possible, of one equivalent of hydrogen, and two equivalents of carbonic oxide, accompanied by the corresponding equivalents of nitrogen gas.

To demonstrate the superior value, as fuel, of the mixture of hydrogen and carbonic oxide, as aforesaid, over carbonic oxide alone, it is sufficient to state the following facts:—The calorific power of the gases obtained by burning 36 lbs. of dry air, and 9 lbs. of heated steam, in an excess of ignited fuel, may be represented theoretically by 3, —they consist of 4 volumes of carbonic oxide, 2 volumes of hydrogen, and 4 volumes of nitrogen—in all 10 volumes; of which the proportions of the combustible are to the incombustible gases as 6 to 4, and if taken by weight as 29 to 28, the total weight being 57 lbs., and the consumption of solid carbon 12 lbs.

The calorific power of the gases obtained by burning, under similar circumstances, 72 lbs. of dry air, without the addition of the heated steam, may be theoretically represented by 2,—the consumption of solid carbon being also, in this case, 12 lbs.; the gases consist of 4 volumes of carbonic oxide, and 8 volumes of nitrogen—total 12 volumes. The ratios of combustible to that of incombustible gases are as one to two, either by weight or volume, and the total weight is 84 lbs.

When equal weights of the two gases are compared, the theoretical calorific powers of each are as 221 to 100, but in practice the useful effect is much more in favor of the mixed carbonic oxide and hydrogen, especially when a high temperature is required. In these calculations no notice is taken of fractional parts, nor of the volatile matters contained in the fuel burned, as they do not alter the economical results. The advantages of employing the combustible gases produced in the manner above mentioned, as fuel, are thus stated:—First. Effectually preventing the smoke nuisance. Second. The power of regulating the temperature in metallurgical and other manufacturing operations in reverberatory furnaces, with a precision extremely difficult to obtain by the usual methods with solid fuel. By varying the proportions of hot air, and of the combustible gases, the heat can be raised or lowered in a moment, and the flame rendered oxidating, or reducing, or neuter, with the facility attending blow-pipe operations on a small scale. The advantages attending such an arrangement will immediately strike any one accustomed to these matters. Third. A complete command over the caloric, and over the volatile gaseous products generated by combustion. When we reflect on the very small proportion of the total heat produced, which can be, or is, utilized in reverberatories depending on common fire-places and chimney draft, the superiority of the gas reverberatories is immediately apparent. In the latter, worked by a blast or artificial current of air, the totality of the heat generated by combustion can be applied to useful purposes in general; the waste caloric will be most effectually expended in heating the air for burning the gas, but there are many other obvious ways of employing it. Fourth. In gas furnaces the necessity of high and expensive chimneys is completely done away with. Fifth. The complete command over the volatile and gaseous products of combustion is of great importance in many metallurgical operations, such as in smelting

* *Newton's Repertory of Arts.*

copper, tin, lead, &c. A nuisance hitherto inseparable from these operations may thus be obviated, and many valuable substances, hitherto wasted, may be turned to useful account. Sixth. The most inferior kinds of fuel, even such as can scarcely be used for any practical purpose in their natural or solid state may be employed to produce valuable combustible gases, in the manner above set forth.

To conclude: after making ample allowance for the costs of generating and heating the steam, of blowing and heating the air, the original costs, and wear and tear of apparatus, &c., it will be found that an enormous saving will be effected by the application of gas fuel generally in metallurgical and manufacturing operations, for heating steam-boilers, and for almost every other purpose for which solid fuel has hitherto been used.

For generating the gases, the patentee prefers to employ a furnace upon the plan used in smelting iron ores, with a fuel-chamber above the boshes of a sufficient height to secure the perfect decomposition of carbonic acid. The furnace should, besides, be provided with close covers or slides, at the charging-plate, and with lateral flues and pipes to convey the combustible gases to their destination.

It is advisable to use a proper flux to convert the earthy parts of the fuel into a fusible slag, which may be run off as formed, or tapped periodically, as may be found, most convenient; open burning fuel, or a mixture of open burning and caking fuel, is more convenient for generating gas than the very bituminous caking sorts; when the latter are used, it might be advisable to employ a stirring apparatus to facilitate the descent of the charges.

To produce the blast, the patentee prefers using steam, at a pressure of from two to three atmospheres. After leaving the boiler, it passes through a common heating apparatus of iron pipes, in which it is heated from 570° to 600° Fahrenheit, or upwards; the steam-pipe is contracted considerably at the jet, which may be made to terminate at or within the mouth of a common open tuyer or tuyers, or be inserted within a closed hot-air tuyer, and, pointing towards the nozzle, the blast of steam will always draw after it a sufficient proportion of air to affect a perfect combustion of the fuel. Hot air is not indispensable, for with cold air the operation succeeds perfectly; but either hot or cold air may be used.

The dimensions of the apparatus will of course vary according to the quantity of solid fuel required to be converted into gases: one gas generator may serve to supply several gas furnaces.

The mode of applying the combustible gases as fuel, and the construction of furnaces, may be varied considerably, according to circumstances; the only thing to be particularly attended to is, to arrange the jets or orifices for the issuing currents of combustible gases and hot air in such a manner, that the mixture of the two shall be as complete as possible, and the combustion be effected at that part of the furnace, where it will produce the most powerful effect. After the flame has done its office in one part of the furnace, it enters an oven, or wide flue, and heats the air-pipes placed therein. Cold air is blown in at the top, and in descending the circumvolutions of the pipes it becomes gradually heated to the degree required; the hot air is conducted, in suitable pipes to the point where the gas jets are situated, and the mixture is there inflamed. Both the gas and air-pipes are provided with throttle-valves or cocks, by which the quantities may be regulated at pleasure. All these matters being well understood, and daily practised with combustible gases obtained from iron furnaces, it will not be necessary to enter into more minute details on the subject.

The patentee, in conclusion, states, that he does not claim, as new, the employment of carbonic oxide gas as fuel; but that which he does claim is the employment of a mixture of carbonic oxide gas and hydrogen, obtained by means of a combined blast of highly-heated steam and atmospheric air, acting on ignited fuel in excess, as above described.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE CALORIFIC POWER OF THE LIGHT OF THE MOON.

(*An extract of a Letter from M. Melloni to M. Arago.*)

A LENS composed of many pieces, one metre in diameter, constructed by M. Henry Lepante, and intended for a meteorological observatory at Vesuvius, has just reached me. To study, without danger, the adjustment of the different rings, as well as the distance and extent of the focus, I exposed this beautiful optical instrument to a clear moonlight, I brought the lens, by means of the double rotatory motion of which it is susceptible, to a plane exactly perpendicular to the direction of the rays: the light that fell on the surface of the lens was concentrated at the distance of about one metre, on a circular spot of the diameter of one centimetre. This little circle, extremely brilliant and clearly defined, of a size equal to the section of the tubes of my thermoscopic piles, suggested to me the idea of trying its action on these piles. The preparations for performing this experiment were immediately made, and a considerable deviation was seen, on the multiplying rheometer, as soon as the rays, penetrating the interior of the tube, fell on the anterior face of the apparatus. Astonished at the quickness of the action, and having some doubt whether it arose from the lunar heat, I placed my hand at a short distance from the front of the opening, and the index of the rheometer immediately returned to zero, passed it, and deviated in a contrary direction—an evident proof that its primitive movement was derived from frigorific radiation, that is to say, from a lowering of the temperature on the face of the pile exposed to the focus. The origin of this cold was easily seen.

As the lens was on an open balcony, and beneath a perfectly clear sky, it ought, on account of the great emissive power of glass, to have radiated its heat into space, and thus reduce the temperature below that of the pile, which was enclosed in its metallic case, and placed in the interior of the apartment. As long as the pile was protected by its metal covering, the feeble radiation of the latter did not allow it to feel the influence of the cold of the lens, but, as soon as the covering was lowered, the calorific exchange took place between the two bodies, and the pile, losing more than it received, necessarily lowered the temperature of the exposed surface, and thus produced the electric current which caused the deviation of the needle of the rheometer. To remedy this inconvenience, I moved the lens within the window, that overlooked the balcony; and I applied a mat to the window, that could be easily raised to allow the lunar rays to enter the room, or lowered to intercept them. I kept the mat lowered until the equilibrium of the temperature was re-established; and after having satisfied myself that the rheometer underwent no deviation, when the covering of the pile was lowered, which always remained at the focus of the lens, I allowed the light of the moon to fall upon the instrument; a deviation of a few degrees of increased temperature manifested itself. I immediately repeated the experiment, and to my great surprise the deviation was in the opposite direction! A few moments' reflection were sufficient to convince me that these changes of direction depended, in all probability, on the gusts of external air that from time to time entered the room, and fell upon the uncovered surface of the thermoscopic body. It was easy to dispose matters in such a manner that the air could not have access behind the lens, but, guided by the theory of the identity of heat, light, and the well known experiment of Saussure with respect to a thermometer placed below a broken window, I imagined we might succeed better by introducing into the interior of the tube two diaphragms of glass, perfectly diaphanous, and well polished on the four faces; the first, at a little distance from the pile, the second close to the opening. I therefore fitted up the tubes of my pile in this manner, and on the first favourable opportunity, I repeated the experiment.

The index of the apparatus remained, at first, stationary for a few instants, then it began slowly to deviate, and after four or five minutes it stopped decidedly on an arc of 3°·7. I withdrew the pile from the focus, and placed it on one side, its opening being still turned towards the centre of the lens; the deviation began immediately to diminish, and in a few minutes the index returned to zero. I frequently repeated the same operation, removing the pile sometimes on one side, sometimes on the other, and the needle always deviated when at the focus, and fell back to zero, when not in that position.

Thus the direction of the deviation corresponded with that of the calorific action.

The experiment was, therefore, perfectly satisfactory, and could not leave the shadow of a doubt. In fact, I had an opportunity of repeating it afterwards in the presence of M. Belli, professor of philosophy at the University of Pavia, and Messrs. Mossotti and Lavagna, of the University of Pisa, and many other distinguished philosophers, who all left my apartment perfectly convinced that the light of the moon is calorific.

When I consider that the philosophers who attempted to discover the lunar heat during the last century employed, according to Laland, lenses of from one metre to 1m, 33c. in diameter, and Amonton's extremely sensitive thermoscope, I strongly suspect that the negative results described by these philosophers, depended, to a great extent, on the cold produced by their lenses, by celestial radiation in conjunction with the reduction of temperature caused by the movements of the external air, to which their instruments were exposed; so that I do not despair of being able to make the phenomenon apparent, with thermoscopes of ordinary power.

In the meantime, by the employment of the present means of observation, I have been able to satisfy myself, that the calorific action of the moon varies, as we might easily foresee, not only with its age, but also according to the height of this celestial body above the horizon. A trifling deviation of the plane of the lens from its normal direction, with respect to the rays also, considerably diminishes the effect. Under these different circumstances, I have met with deviations which have varied from 0°·6 to 4°·8. The action through the glasses is so gradual that the index of the apparatus moves with admirable regularity, and without the least oscillation, whether in moving from its point of equilibrium, when the thermoscopic body is placed in the focus of the lens, or in returning, when we have scarcely moved it out of the focus, but always keeping it facing the lens. When performed under different lunations, the experiment has always succeeded, that is, the result has been always more or less decided, but in every case indicating an increase of temperature, I shall, therefore, repeat, that the fact of the existence of heat in the moon's radiation is perfectly certain, all that remains is to measure this calorific action, and to ascertain—1. What is its amount in thermometrical degrees. 2. What is its proportion to the solar heat? I shall endeavour to resolve these two great questions; but, with respect to the last, under what degree of approximation ought we to consider the fraction $\frac{1}{300000}$ given by Bouguer, to represent the proportion between the illuminating power of the moon and that of the sun?

POISONING BY TARTAR EMETIC, AND APPEARANCES AFTER DEATH.*

BY DAVID HARTLEY, ESQ.

Two children—a boy, aged five years, and a girl, three years of age—were each given a powder containing about ten grains of tartar emetic, mixed with a little sugar. The boy died about eight hours afterwards; the girl lived for four or five hours longer. Mr. Newman and myself were ordered by the coroner to make the necessary examinations of the bodies; this we did about one hundred and eleven hours after the death of the first child, whose body we found not at all emaciated, or presenting any external signs of disease. The abdomen was not distended. On opening the thorax, there was a slight adhesion of the left pleura, and about three drachms of serum were found in the right pleura. The anterior surface of the lungs appeared healthy; the posterior surface more red than usual, particularly at the lower lobe of the right lung; heart natural; there was a little dark blood in the right ventricle; the coronary vessels were very fully injected. In the abdomen, we found the liver healthy, the gall-bladder empty, the peritoneal coat of the intestines injected, evidently from recent inflammation. The stomach and its contents were removed. The mucous membrane of the duodenum was inflamed, and covered with a whitish-yellow viscid secretion; this was observed throughout the intestinal canal, though more yellow in the colon and rectum; there was no ulceration. The other abdominal viscera were healthy, and presented no abnormal appearance. The jaws were so firmly set, that there was great difficulty in opening the mouth. The tongue was covered with a white fur, and appeared soddened; the fauces were not inflamed; the trachea and œsophagus had a natural appearance. On opening the cranium, the dura mater was found very vascular; the longitudinal sinus contained a coagulum of lymph, but very little blood; the vessels on the surface of the brain were very much injected with dark blood, the whole surface having a deep purple appearance. Every portion of the brain, when cut into, presented many bloody points; the cerebellum and medulla oblongata were also extremely vascular; there was no

* *Lancet.*

effusion in the ventricles or at the base of the brain. The stomach (the peritoneal coat of which was inflamed) contained about two ounces and a half of dark grumous fluid, but it was not distended with gas. On opening this viscus, the mucous membrane was found very much inflamed about the larger curvature, also at the cardiac orifice; there was no ulceration; the contents were very adherent to it, and in one place was a patch of lymph. On testing the contents, there was a slight acid reaction; but no test that was used indicated the presence of any antimony although the same tests applied to a mixture of one part of solution of tartarized antimony, and two of distilled water, displayed the characteristic appearances.

In the other child, the morbid appearances were similar, though not to the same extent; there were also patches resembling the eruption of scarlatina on the arms, legs, and neck. The arachnoid membrane was more opaque than usual; and on the mucous membrane of the stomach, where the inflammation was greatest, were two or three white spots, each about the size of a split pea, and which, with the aid of a magnifying glass, appeared to be the commencement of ulceration.

I did not see either of the children before death, but I ascertained from the relatives, that about twenty minutes after taking the powders, they had been seized with violent vomiting, and purging, and great prostration of strength, followed by convulsions and tetanic spasms. Mr. Newman, who was called in after the death of the first child, found the little girl had a remarkable distortion of countenance, with strabismus, violent convulsions of the limbs, and a peculiar tetanic spasm of the jaws, as though she was endeavouring to bite anything within reach; there was also great thirst, and extreme prostration of strength.

The children were said to have been in good health till the morning on which the powders were taken, when they complained of pain in the back, and headache, for which symptoms the mother had usually administered emetics.

THE ALKALOID SALTS, AND THEIR RELATIVE INFLUENCE ON THE ANIMAL FRAME.*

BY MESSRS. T. AND H. SMITH, EDINBURGH.

It has often occurred to us, that a great deal of error exists among medical men, and that their ideas are exceedingly vague, regarding the effects of the action of medicines produced by peculiar states of combination, but more especially in the case of the more active vegetable alkalis. For instance: when a salt of morphia is used, one person prefers a muriate, another a sulphate, and a third thinks that an acetate can alone secure the desired effects of the drug, unaccompanied by the idiosyncratic or disagreeable after-effects, so apt to occur in some constitutions.

We think, that the most proper way to arrive at a clear understanding, of the real influence caused by the acid in a powerful vegetable salt—say an acetate, or sulphate of morphia—is to take into account the equivalents of its proximate constituents.

Let us, for example, take the muriate of morphia. The equivalent of morphia itself, like most of the active alkaloids, is very high, being close upon 300. The equivalent of muriatic acid is only 37, being about a tenth of the equivalent of muriate of morphia; and, as the medium dose of this last is only about the eighth of a grain, a single dose can only contain about the 80th of a grain of muriatic acid. As the equivalent of acetic acid is 51, and that of sulphuric acid 40, the argument applies with equal force to sulphates and acetates. Now is it not unreasonable, and as much an outrage upon common sense, as the wild doctrines of homœopathy, to suppose for one moment that it can be of the least possible consequence to the patient whether the salt given be an acetate, a muriate, or a salt of any acid whatever? It may be said, that, by the combination, a peculiar change is produced, analogous to what occurs when a strong mineral acid is neutralized by an alkali, where the characters of both constituents are destroyed, and a new substance, possessing entirely new properties, produced. We do not think this is the case, in so far as medicinal action is concerned. We do not know a single fact sufficiently strong to give the least countenance to such an opinion. The only result, we conceive, that can take place, by combining the alkaloid with an acid, is to obviate any impediment to its complete and quick action on the nervous or absorbing surface with which it is brought into contact. It is certain, that in the case of acetate of morphia, where perhaps this preference has been more shown, and the propriety of which has been less called in question than in any other instance, there must be some fallacy in the circumstances supposed to prove its superiority over the muriate; for there can hardly fail to be as much muriatic acid in the stomach, in the greater number of cases, as would be suffi-

* *Lancet.*

cient to decompose the acetate—a consequence resulting from its acid being so far behind the muriatic in strength of affinity; so that, although the acetate be the salt taken, the action on the system is that of a muriate, and not of an acetate.

In fixing our choice on the salt deserving of preference, the reasons on which we should found our judgment should be of a description somewhat like the following:—Which is the most readily and easily prepared? which is most readily got in a state of purity, and sufficiently soluble? and which is least liable to change or decomposition? Taking these characters for guides, in the case of the morphia salts, the muriate ought decidedly to get the preference. In the case of the quinine salts, the sulphate should be preferred, for; on account of its sparing solubility on crystallising, the greater part of the impurities are left behind in the abundant mother liquid.

It has also occurred to us, that it might be advantageous to medical men, to suggest, that in administering externally some of the alkaloids, such as aconitina and veratria, in the form of ointment, the activity of the remedy would be more effectually secured by dissolving them in a few drops of a weak acid, such as the acetic, before mixing them with the ointment. In this way their absorption is more effectually secured, and disappointment in the result less likely to happen. In the case of aconitina, we have in this way proved on our own persons its increased activity; and; if we mistake not, there is a fact of a similar nature in Dr. Fleming's lately published essay on "Aconitum."

INDIAN REMEDIES.*

BY WILLIAM WINDER.

ALTHOUGH the Indians, being without the advantages of science to guide them in their choice of remedies in the treatment of disease, derive their principles from mere experience, it is certain that we are indebted to their Materia Medica for many valuable articles of a vegetable kind. It is certain that they are frequently successful in the adaptation of these articles to complaints of a formidable character.

One of the remedies in great use amongst them is the *Geranium maculatum*, which many eminent physicians of the United States rank as one of the most powerful vegetable astringents, being principally composed of tannin and gallic acid. In the second stage of dysentery and diarrhœa, after evacuants, in hæmorrhages of the alimentary canal, and as a styptic in external bleedings, it rarely fails of giving relief. Its dose is from gr. x. to ʒss. of the powder, or ʒss. to ʒj. of a decoction made with a drachm of the root to half a pint of boiling water. With the Indians it is a favourite external styptic, the dried root being powdered and placed on the mouth of the bleeding vessel. It is also much used by them as a wash in leucorrhœa. Internally, in doses of half a teaspoonful in cold water, they consider it very efficacious in hæmoptysis; and in this opinion they are fully sustained by Thacker, Mease, Bigelow, and others.

The *Xanthoxylum fraxineum*, or prickly ash, is one of the most valuable remedies of the Indians for the cure of rheumatism. It is said to resemble guaiacum in its properties, and is much used by the Americans as a remedy in chronic rheumatic complaints, and particularly in cases of a syphilitic taint. Bigelow says he gave the bark of this shrub in doses of 10 and 20 grs. with great advantage.

The *Xanthoriza apifolia* is an excellent tonic. Its composition is principally resin and gum, and the taste is intensely bitter. The dose is ʒij. of the powdered root. The Indians administer it as a diuretic, in dropsy, and also use a cold watery infusion for sore eyes.

A favourite and well-known remedy with the Aborigines is the *Eupatorium perfoliatum*, having the familiar names in the United States of boneset, crowswort, thoroughwort, &c. Its taste is intensely bitter, with a slight astringency, but no acrimony; and its operation is tonic, sudorific, cathartic, according to the mode of its exhibition. It is given in cold infusion in intermittents, continued fevers and inflammatory diseases; to produce vomiting and catharsis, in hot infusion; and as a tonic, in substance. In the United States' Pharmacopœia there is an officinal formula.

Infusum Eupatorii.—The natives administer it with good effect in fever, and as a common drink in acute rheumatism, pouring a quart of boiling water on two drms. of the leaves, and drinking about three ounces three times in the day.

The *Cornus florida*, dog wood, is said to differ little in its chemical composition from the Peruvian bark; and Dr. John Walker states, that of all the indigenous tonics this is the most beneficial in intermittents. Thirty-five grs. of dog wood bark are said to be equal to 30 grs. of cinchona. The

* *Monthly Journ. of Med. Science*, April, 1846.

Indians use a decoction of small branches and buds, in cases of want of appetite and debility of the stomach. It is valued also as a poultice to correct ill-conditioned sores.

The *Polygala Senega* is too well known to need description. It is much used by the Indians, who give it in cold infusion during the remission of fevers, attended with great prostration of strength; and in diseases of the pulmonary organs. They also esteem it highly, in female complaints; and in this agree with Dr. Chapman, who considers it the most efficacious emmenagogue, and useful in all forms of amenorrhœa.

It is not a little remarkable, that among all the Indian tribes known to Europeans, the production of increased perspiration constitutes one of their principal remedies. A favourite and universal mode of procuring this is by the use of the vapour-bath. The construction of this is similar throughout the different nations of the north-west. Mr. Cormack, in the account of his expedition to discover the Aborigines of Newfoundland, or Red Indians, says that he discovered in a deserted village the remains of a vapour-bath. The method used to raise the steam was by pouring water on large stones made very hot. Over these a hemispherical frame-work, closely covered with skins, was placed to exclude the external air. The patient then crept in under the skins, with a birch-rind bucket of water, and a small bark dish to pour the water on the stones, and thus enable him to produce the steam at pleasure. He remains so long as the heated rocks retain sufficient heat to raise the vapour, when he retires, wrapped in a robe or blanket, and goes to bed. The bath is principally used in rheumatism, dropsy, and the cold stage of fever. Warm sudorific infusions are taken in the bath; and the debility induced is sometimes so great that the patient faints; which, however, followed by proper treatment, generally has a beneficial effect.

I have said that the Indian is guided by experience in the treatment of disease. For example, when suffering from acidity of the stomach, he takes some of the absorbent earths that are found on the banks of the rivers. Bleeding, in their inflammatory diseases, is also much used. But the simple native of the forest does not employ the former from any knowledge he possesses of the principles of chemistry, nor the latter from any acquaintance with the laws of physiology.

A modern writer states, that in their febrile diseases they make the state of the skin and bowels the guide by which to regulate their practice. When the skin is mois for a considerable time, and the thirst ceases, they say there is no danger. When the evacuations from the bowels become less offensive and change their colour, the tongue becoming clean, they stop purging and diaphoresis. If there be great debility, they commence giving tonics, which are commonly bitters. Should these induce costiveness or a return of the fever, evacuants are again had recourse to. There is something so rational, and yet so simple, in all this, that I hardly think we should find anything to improve upon it in Sydenham or Cullen; and, as the great Boerhaave tells us, that "simplicity is the seal of truth," probably there is here as much practical unsophisticated truth as will be found in the elaborate treatises of ancient and modern professors.

That the Indians are acquainted with the mode of relieving inward pains by treatment similar to the moxa, is seen by their burning a piece of touchwood over the pained part, and suffering it to produce a blister. They are also aware of the advantage of relaxing the muscles in dislocations; for, in cases where they do not succeed readily, they nauseate the patient to a distressing degree, and then find very little difficulty in reducing the luxation. Tumours and abscesses are allowed to suppurate generally without any application to them. When much inflamed and painful, plasters of bruised herbs or warm fomenting poultices are used. If matter forms, they make an incision for its escape, and continue the poultices to promote the discharge.

ON THE DISORDERS OF WORKMEN EMPLOYED IN THE MANUFACTURE OF LUCIFER MATCHES, AND ON CERTAIN HYGIENIC AND ADMINISTRATIVE MEASURES NECESSARY TO RENDER THE WORK WHOLESOME.*

BY DR. THEOPHILUS ROUSSEL.

The object of this work is—1. To explain the various operations in the now important manufacture of lucifer matches. 2. To discover the cause of the numerous accidents, fires, explosions, &c., occasioned by this branch of industry. 3. To determine all the conditions that may concur to produce disease among the workmen. 4. To observe the development of these diseases, and to point out the means of preventing them.

In studying the different branches of the manufacture, it is easily seen that the unhealthiness is only attached to a small num-

* *Comptes Rendus.*

ber of them; and that, by means of a proper separation of the workshops—a separation that would not be injurious to the economy of labour—we should be able, in the first place, to reduce to at most one-fifth of the whole, the number of those who are exposed to the emanation of the phosphorated vapours, the only cause of the insalubrity attached to manufactories of lucifers.

The examination of workmen exposed to the action of these vapours demonstrates the existence of more or less severe affections of the respiratory passages, and also of the gums and maxillary bones, terminating in necrosis, and sometimes in the death of the patients.

AFFECTIONS OF THE RESPIRATORY PASSAGES.

In manufactories where all the operations are performed in the same place, all the workmen are indiscriminately subject to cough. But in the greater number of cases, this cough, which is but little painful, is of little inconvenience, and only occurs at intervals, in damp weather, and when bad ventilation allows the phosphorous vapours to accumulate in the workshops.

In establishments where the workshops are distinct from each other, cough and bronchitis only exist among those workmen who dip the matches in the chemical composition, and among the women who remove the dipped matches from the stands on which they are placed, and fill the boxes and make up the packets. In the cases of many of the women, the bronchial irritation passes to a chronic state, but among none of them have we met with the serious symptoms observed by M. Gendrin; it is true that in this state of the disease, the work-people are no longer in the shops, but at the hospital. A certain number of facts lead us to believe, that the long continued action of phosphorous vapours determines the development of tubercles in such as are predisposed. The phosphorous emanations appear to act in the same manner as irritating substances, and not from any special powers.

The disease of the maxillary bones is much more serious than the preceding.

The antecedents of those affected, the examination of their constitution, &c., enable us to affirm, that in the greater number of cases, syphilis and scrofula are foreign to the development of the disease; that the latter has not appeared until after a sojourn of at least two years in the manufactories, and that all the individuals affected, were habitually exposed to the phosphorous vapours. In endeavouring to discover the peculiar circumstances of the health of these individuals, we were struck with the fact that one or more of the teeth have been affected a considerable time before the appearance of the evil; or even before the party affected entered the factory. On the other hand, we are assured, that workmen who came to the factory with sound teeth preserved them untouched, and exhibited no affection of the jaws. Thus we are able to refute what has been said of the action of acid phosphoric vapours on the teeth, and on the influence attributed to this circumstance, in the production of the disease of the maxillary bones. We are induced, on the contrary, to believe, that the caries of the teeth plays a principal part, which has not been suspected in determining the disease. The latter begins by pain in the teeth, and by discharges; at the end of some time, the teeth become loose, and fall out of themselves, or the pain obliges the workmen to have them taken out. The discharge soon makes so much progress that abcesses are formed, which open, either in the mouth, through the substance of the gums, or in the face or neck; according as the seat of the disease is in the upper or lower jaw. We observed in one case, that the pus that flowed for the first few days had a very strong phosphorous smell.

In other cases, no abscess is formed, but when the teeth have been extracted, or have fallen out, the opening in the gums, instead of cicatrising, remains open, and a gray and fetid pus soon escapes, which occasions a constant salivation. The suppuration becomes every day more abundant, the substance of the gums is destroyed, and the maxillary bone becoming dead, over a larger or smaller part of its surface, is laid bare in the mouth, and finally, it loosens, becomes detached, and falls off.

If the patients follow a proper regimen, a cure may take place, but more frequently the destruction caused by the constant salivation, and particularly by the continuous and fetid suppuration, gradually destroys the patients. Digestion becomes deranged, fever supervenes, and the unfortunate workman soon succombs. M. Heyfelder endeavoured to effect a cure by excision, but failed.

The disease may exhibit itself either on the upper or lower maxillary bone, on one or both sides at the same time, and even on both the maxillary bones.

The reasons given by M. Strohl, for distinguishing this disease from necrosis, and also from caries, are not well founded. The characters of the pus, with the exception of the phosphorous odour, which is not sufficiently established, and those of the separation, are common to all the necroses of the maxillary bones in general. The character

drawn from the absence of the regeneration of the osseous tissue, has been contradicted by observation. It cannot be doubted, in our opinion, that it is not derived from the exhalations that deteriorate the atmosphere of the workshops; but to what agent can we attribute it? In Germany it is charged to the arsenical vapours, which, in some manufactories, are mingled with the vapours of phosphorus, but the injuries produced by arsenical vapours have no resemblance to those we have described, and on the other hand, we have met with disease of the maxillary bones, in workshops where arsenic is not employed directly, nor arsenical phosphorus.

Ought we to attribute it to the vapours of phosphoric acid? May we not suspect the action of phosphorus in a gaseous state in the atmosphere of the workshops? We are not enabled to answer these questions.

The measures we propose to render the manufacture of lucifer matches healthy consist;—1, in the complete separation of the workshops, so as to remove the largest of them as much as possible from the phosphorous emanations; and, 2, in the establishment of proper modes of ventilation in those shops that cannot be completely freed from those emanations.

ON THE ADMINISTRATION OF SULPHATE OF QUININE IN A WEAK DOSE, AND BY FRICTION ON THE INTERNAL PARIETES OF THE MOUTH AND LARYNX.

BY M. DUCROS.

Sulphate of quinine employed as a lotion on the tongue, the velum palati, the inside of the cheeks, or the vertebral flooring of the throat, produces, in the dose of five centigrammes, an abundant salivation, with a very decided bitter taste, and thus we produce a double result; on the one hand the action is much more powerful, and more rapid, than if the dose is pushed to two grammes, and introduced into the stomach or intestines; and, on the other hand, we are in no fear of the intoxication that sometimes accompanies the employment of this medicine in the ordinary manner.

The rapidity of its action is particularly important in dangerous intermittent fevers. Sulphate of quinine administered as a lavement, or in pills, does not act until the end of five or six hours; but when applied to the fauces, if we can only administer it half an hour before the third attack, which is so often fatal, the reaction has time to take place.

THE ORIENTAL BEZOAR—AN ELLAGIC-ACID CALCULUS.

Mr. Taylor, in an interesting communication to the *Philosophic Magazine*, describes this calculus, to which so many sanative virtues were formerly attributed. He finds it composed of "ellagic acid," the peculiar insoluble acid obtained by Braconnot from the infusion of galls. They are generally taken from one of the stomachs of the wild goats of Persia, and also from this viscus in some other species. Mr. Taylor remarks, that its chemical composition removes the uncertainty as to the origin of the bezoar, and proves that it is derived from the juices of the plants and fruits on which the animals live.

BOILING POINT OF WATER AT DIFFERENT HEIGHTS.*

BY M. REGNAULT.

The following table has been made out by M. V. Regnault to aid in determining heights by the boiling point of water, a method recommended alike by its simplicity and the portable character of the instrument, and now very commonly adopted in preference to the barometer. The calculated results are shown to vary less than half a line in height of the barometric column from those obtained by observations.

M. Regnault states that the thermometer should be made of the best crystal glass, as others dilate irregularly. They are graduated from 75° to 100° C. (equivalent to 167° to 212° Fahr.), and the following is the method adopted for this purpose. As much mercury is introduced in the usual way as will stand one third up the stem when placed in melting ice; this point (designated n) is accurately marked. The tube is then placed alongside of another graduated thermometer in a large vessel full of water, kept agitated, and exactly at 20° C. (68° Fahr.); the height of the mercury (n') correspouding to the degree of temperature (t) indicated on the graduated scale is noted. $\frac{n'-n}{t}$ will then give the value of a degree. A portion of the mercury is next expelled, so that it will reach towards the top of the tube when in boiling water, and the tube is closed as usual. It is then placed in the vapour of boiling water under a pressure of about 760 millimetres, and the point at which the mercury stands (n'') is noted, and also the exact temperature (T). The value of a cor-

* *Ann. de Chim. et de Phys.*

ter. This is inserted in a
vessel, which has a lamp at
ermometer is dropped down
just above the surface of the

s for each tenth of a degree
ween 85° and 101°, the
metric pressure reduced to
to the temperatures ob-
g water. The calculations
measures. A millimetre
n inches. The Centigrade
he table.

ILLIMETRES FROM 85 TO

Diff.	Degree.	Tension.	Diff.
		mm	
20	97·0	682·03	2·49
21	97·1	684·52	2·50
22	97·2	687·02	2·51
22	97·3	689·53	2·51
23	97·4	692·04	2·52
23	97·5	694·56	2·52
25	97·6	697·08	2·53
25	97·7	699·61	2·54
26	97·8	702·15	2·55
26	97·9	704·70	2·56
27	98·0	707·26	2·56
28	98·1	709·82	2·57
29	98·2	712·39	2·58
29	98·3	714·97	2·59
30	98·4	717·56	2·59
31	98·5	720·15	2·60
31	98·6	722·75	2·60
32	98·7	725·35	2·61
33	98·8	727·96	2·62
34	98·9	730·58	2·63
34	99·0	733·21	2·64
35	99·1	735·85	2·65
36	99·2	738·50	2·66
36	99·3	741·16	2·67
38	99·4	743·83	2·67
38	99·5	746·50	2·68
39	99·6	749·18	2·69
39	99·7	751·87	2·70
40	99·8	754·57	2·71
41	99·9	757·28	2·72
41	100·0	760·00	2·73
42	100·1	762·73	2·73
43	100·2	765·46	2·74
44	100·3	768·20	2·75
45	100·4	771·95	2·76
46	100·5	773·71	2·77
46	100·6	776·48	2·78
47	100·7	779·26	2·78
48	100·8	782·04	2·79
48	100·9	784·83	2·80
	101·0	787·63	

THE PHYSIOLOGICAL EFFECT OF SULPHURIC ETHER WHEN APPLIED TO THE MOUTH AND PHARYNX, IN MAN AND ANIMALS.*

BY M. DUCROS.

THE author announces that he has employed, successfully, sulphuric ether to procure sleep, in the case of persons subject to hypocondria, after having in vain employed every other kind of opiate, for the same purpose. M. Ducros, in these cases, administers the ethers by friction on the tongue, the velum palati, the kernels of the ear, and and the vertebral floor of the throat. Employed in this manner, among gallinaceous birds, ether, says M. Ducros, produces instant sleep.

IMPORTANT ANNOUNCEMENT BY THE APOTHECARIES' COMPANY.

"THE Society of Apothecaries, anticipating the probability of a change in the laws which regulate the practice of Physic and Surgery in this country, were unwilling, while the Medical Bill of the Secretary of State for the Home Department was still before Parliament, to have recourse to proceedings of a penal character for enforcing an observance of the 'Act for better Regulating the Practice of Apothecaries throughout England and Wales.' Sir James Graham, however, having intimated that it is not his intention to re-introduce any similar measure at present, and it appearing that numerous individuals are entering upon the practice of medicine who have given no evidence of their possessing the requisite skill and ability for such practice, to the serious risk of the public health, and to the discouragement of a zealous course of study on the part of medical students, the Society of Apothecaries deem it to be their duty to give this public notice, that they will use their utmost endeavours to secure to all classes the full benefit of the provisions of the Apothecaries' Act, and that upon being furnished with the names of individuals alleged to be practising as apothecaries without having submitted themselves for examination and obtained the certificate of qualification required by law, accompanied by adequate proof of such illegal practice, the Society will forthwith institute the necessary legal proceedings for the punishment of the offenders.

"By order of the Master, Wardens, and Court of Assistants.

"ROBERT B. UPTON,
"Clerk to the Society."

"Apothecaries' Hall, April 7, 1846."

IV. REVIEWS AND NOTICES OF BOOKS, &c.

BURIAL GROUND INCENDIARISM. By Geo. Alfred Walker, Surgeon. London: Longman and Co.

THE author of the present work is well and honourably known for his exertions in the cause of the public, in reference to the sanatory condition of towns, as far as the burial of the dead within the precincts of large cities is concerned. We believe his first work on the subject was entitled "Gatherings from Grave-yards," and in it he exposed not only the unavoidably unhealthy nature of places of burial, in crowded neighbourhoods, but, also, the mal-administration of several of these receptacles of the dead, arising from the cupidity of the proprietors, when they were attached to chapels, and of the incumbents of parishes and others, when connected with episcopalian places of worship.

Few were bold enough to endeavour to confute his arguments, as to the injury inflicted on public health by the existence of these accumulations of corruption in populous places; but great was the outcry against the invasion of vested interests, which, in this instance, were to be considered as paramount to every public benefit. Mammon had erected his altar even in sacred places, and the ministers of religion, in many instances, opposed every reform in the system, for the sake of—filthy lucre! The author was also accused of falsehood, and denounced as an agent for the cemeteries, which are now springing up around the metropolis, to the manifest benefit of the health of its population.

The two nuisances, *par excellence*, were the Spafields burying ground, and a miserable place of burial under Enon chapel; until lately a place of worship, in the confined neighbourhood of Clement's Lane,

* *Comptes Rendus.*

This horrible cellar, for it is little else, is thus described by the author:—

"Enon Chapel is situated about midway on the western side of Clement's-lane; it is surrounded on all sides by houses, crowded by inhabitants, principally of the poorer class. The upper part of this building was opened for the purposes of public worship about 1823; it is separated from the lower part by a boarded floor; this is used as a burying-place, and is crowded, at one end, even to the top of the ceiling, with dead. It is entered from the inside of the chapel by a trap-door; the rafters supporting the floor are not even covered with the usual defence, lath and plaster. Vast numbers of bodies have been placed here in pits, dug for the purpose, the uppermost of which were covered only by a few inches of earth; a sewer runs angularly across this 'burying-place.' A few years ago, the Commissioners of Sewers, for some cause, interfered; and, ultimately, another arch was thrown over the old one. In this operation many bodies were disturbed and mutilated. Soon after interments were made, a peculiarly long narrow black fly was observed to crawl out of many of the coffins; this insect, a product of the putrefaction of the bodies, was observed on the following season to be succeeded by another, which had the appearance of a common bug with wings. The children attending the SUNDAY-SCHOOL, held in *this chapel*, in which these insects were to be seen crawling and flying in vast numbers during the summer months, called them 'body bugs.' The stench was frequently intolerable; one of my informants states, that he had a peculiar taste in his mouth during the time of worship, and that his handkerchief was so offensive, that, immediately upon his return home, his wife used to place it in water. The parish authorities interfered upon the subject of poor-rates, proposing to impose a mere nominal one, if the place were closed; this was done for about twelve months. In defiance of opinion, however, it was again employed for the purposes of interment, and has been so used up to the present time. I am acquainted with many who have been seriously affected by exhalations from the vault, and who have left the place in consequence.

"'Some months since (October, 1839), hand-bills were circulated in the neighbourhood, '*requesting parents and others to send the children of the district to the Sunday-school,' held immediately over the masses of putrefaction in the vault beneath.*

"Residents about this spot, in warm and damp weather, have been much annoyed with a peculiarly disgusting smell; and occasionally, when the fire was lighted in a house abutting upon this building, an intolerable stench arose, which it was believed did not proceed from a drain. Vast numbers of rats infest the houses; and meat exposed to this atmosphere, after a few hours, becomes putrid.

"This place is familiarly known among undertakers by the appellation of the 'Dust-Hole,' and is a specimen of one of the evils which sprang up during the operation of certain laws that were hostile to the cultivation of anatomical science, which have happily now been repealed. The professed security of the dead was made the pretext; individual advantage was the real object for depositories of this description. The health and comforts of the living were entirely disregarded, and the annoyance and dangers resulting from the proximity and effluvia of decaying animal substances were submitted to and hazarded by survivors, rather than subject themselves to the tormenting anxieties which arise from the apprehension of a brutal exhumation.

"This space measures in length 59 feet 3 inches, or thereabouts, and in width about 28 feet 8 inches; so that its superficial contents do not exceed 1,700 square feet. Now, allowing for an adult body only 12 feet, and for the young, upon an average, six feet—and supposing an equal number of each to be there deposited, the medium space occupied by each would be nine feet; if, then, every inch of ground were occupied, not more than 189 (say 200 in round numbers) would be placed upon the surface; and admitting (an extravagant admission most certainly) that it were possible to place six tiers of coffins upon each other, the whole space could not contain more than 1,200; and yet it is stated with confidence, and by credible authority, that from 10,000 to 12,000 bodies have been deposited in this very space within the last sixteen years!"

Such was "Enon Chapel" in 1840, and such in the main points it remains now, although closed as a place of burial.

The Spafields burial-ground was—is?—a nuisance of the same nature, but seen under a different aspect, a variety, of the same species. The following description will enable our readers to gain some idea of this receptacle for the dead, and of the practices that have been carried on within its boundaries.

"This ground is surrounded by houses, many of them tenanted by respectable individuals. On the right is a one-story erection, called a *bone-house*. For some months past the neighbouring inhabitants having observed flame and sparks issuing from the chimney,

entertained apprehensions that improper practices were in progress, and, on a recent occasion, called upon the engine-keeper of the parish for his assistance in extinguishing what they believed to be a fire. He demanded admission, but was refused and resisted by the grave-digger. Being determined, however, to execute his duty, he seized a crow-bar, and having threatened to break in the door, it was opened. He observed a great quantity of coffin wood piled round the room drying, a fire made entirely of coffins in the grate, and portions of human bones also. The engine-keeper particularly noticed the appearance of the chimney, and charged the grave-digger with having used water to extinguish the flame, which was denied; and he was told that what he 'thought was water was pitch;' and this was the fact. Thick flakes of pitch were adhering to the inside of the chimney, thus giving palpable evidence of the material consumed, viz., coffin wood—about 2lbs. of pitch being used in 'pitching' round the inner joints of an ordinary coffin.

"The inhabitants of Exmouth Street Fletcher Row, Vineyard Gardens, and Northampton Row, in the immediate neighbourhood, have frequently complained of 'a tremendous stench' of a peculiar kind, which they say proceeds from the burning of human remains and coffins.

"On a late occasion, when Walters, the engine-keeper—an active, intelligent, and determined man—proceeded with the engine on an alarm of fire in the bone-house, he was surrounded by a great crowd composed chiefly of women, who declared that 'the stench was abominable,' and adjured him 'for God's sake to do all he could to get rid of it.'

"Wheel-barrow loads of coffin wood have frequently been removed across the ground from an opposite building to the bone-house, and hot ashes conveyed from it in return and thrown into the graves.

"This burying-ground does not contain more than two acres, which will receive and give decent burial to 2,722 adults. Spa-fields ground has been employed for interment upwards of 50 years. The average yearly number may be stated at 1,500. There have been 36 burials in one day, but, strange to say, scarcely a human bone can be seen on the surface, it being the practice to have the ground raked and levelled every Monday morning."

The necessary consequence of this state of things was the increase of febrile diseases in the neighbourhood. These facts being brought under the notice of the authorities, the burnings were discontinued and the worst portion of the ground was enclosed; but still the injury to the health of the neighbourhood seems undiminished, and, only a few days since, it was stated by a medical practitioner residing in the neighbourhood, that disease was frequent in the locality, on account of the newly-made graves being filled by the filthy drainings from the abandoned ground, the liquid being afterwards pumped out and conveyed into the common sewer, to the manifest injury of the health of the district. Much has already been done for the improvement of the health of the metropolis; and the decreasing ratio of deaths prove that the exertions of the Government and individuals have been, to a certain extent, successful; and we doubt not that the perusal of the pamphlet now lying before us, will still further tend to increase the efforts now making to improve the health of our dense population, and consequently the intellectual and social condition of society; for the healthy state of the mind and the body are so intimately connected that one cannot exist without the other.

THE HALF-YEARLY ABSTRACT OF THE MEDICAL SCIENCES, &c. &c. Edited by W. H. Ranking, M.D., Cantab. Vols. I and II. London: Churchill.

THE object of these useful volumes, the first two of a series now in the course of publication, at intervals of six months, cannot be better expressed than in the words of the editor, who, after showing the difficulty under which the professional man labours, to follow out the progress of science, on account of the multiplicity of works through which he would be obliged to wade, observes, speaking of these volumes:—

"It is intended therein to place before the profession, the practically valuable information gathered from the records of all countries, in a form so condensed and tangible, that the man in active practice, to whom economy of time is of the utmost consequence, shall be able at a glance to make himself familiar with the discoveries, new doctrines, and improvements in each department of medical science, the seeking of which in their original sources, would have involved such a sacrifice both of time and money as few would think themselves justified in encountering."

We need not say how perfectly we agree with the observations of the editor, inasmuch as the carrying out a similar object, has been our constant effort in the pages of *The Chemist*, with this advantage, as we hope, the being enabled to lay the same description of

information before our readers at an earlier period after its first promulgation. The object of the work before us extends over the whole field of medical, surgical, and chemical discovery, and it well deserves a place in the library of the professional man.

OUTLINES OF THE COURSE OF QUALITATIVE ANALYSIS FOLLOWED IN THE GIESSEN LABORATORY. By Hen. Will, Ph. D., and with a preface by Baron Liebig. London: Taylor and Walton.

The design of this useful work is to afford the student in comparative analysis a well digested text-book, to which he can refer while preparing his studies in the laboratory. The various chemical reagents with which we are acquainted are here systematically arranged, and their comportment, under various circumstances, laid down in a lucid manner, so as to be of easy reference. In addition to this, the book contains instructions for conducting qualitative analysis, which will be found of great use to the student, by enabling him to pursue his researches with more certainty of purpose. The tables that accompany the work will, also, in many cases, be extremely valuable. And as it appears under the authority of that earnest labourer in the field of comparative analysis, Baron Liebig, it bears a sufficient mark of its merit to recommend it to the scientific public.

MISCELLANEA.

ON THE BORING APPARATUS OF THE CARNIVOROUS GASTEROPODS, AND OF THE STONE AND WOOD-BURROWING BIVALVES. *

BY ALBANY HANCOCK, ESQ.

During the investigation of the anatomy of the *Eolidæ* by Dr. Embleton and myself, we ascertained, as appears in the last number of the 'Annals,' that the teeth of these animals are composed of silex. Directed by this interesting fact, I was induced to examine the nature of the instrument by which the carnivorous gasteropods pierce the testaceous covering of bivalve and other shells. I found this apparatus in *Buccinum undatum* to be composed of rows of stout, much-curved spines or teeth, of great brilliancy, and as glossy and transparent as glass, and certainly to have no appearance whatever of horny tissue. They are so similar to those of *Eolis*, that there could be little doubt that they are formed of the same material; and accordingly, after subjecting them to the action of acid, such was found to be the case. Their capacity to drill holes in calcareous matter is, therefore, easily understood, without the necessity of supposing the aid of a solvent requisite, as surmised by Cuvier.

This result was to be expected after the discovery of the siliceous nature of the teeth of the *Eolis*; but that the wood and stone-burrowing bivalves should work out their excavations by an instrument provided with the same material, may, perhaps, appear somewhat startling. Such however I believe is the fact; a fact which, if established, will at once explain all the phenomena attending this much-controverted problem. It is not my intention at present to enter into details; all that I now wish to communicate is the result at which I have arrived; and in a short time I hope to have the pleasure of publishing, at length, my observations in connexion with this interesting subject.

The excavating instrument of *Pholas* and *Teredo* is formed of the anterior portion of the animal, in the surface of which are imbedded siliceous particles. The particles penetrating the skin give to it much the character of rasping paper. The whole forms a rubbing surface, which being applied closely to the bottom of the cavity by the adhesion of the foot, enables the animal to rub down, and so penetrate shale, chalk, wood, or even the hardest limestones and marble.

Saxicava rugosa is also furnished with a rasping surface covered with siliceous particles. This surface, however, in this species is formed entirely of the anterior portion of the mantle, the margins of which being united are much thickened, forming a sort of cushion capable of considerable protrusion at the will of the animal. The foot is small, and passing through a much-constricted orifice, gives origin to a byssus, which anchors the shell close to the base of the excavation, and thus holds the rubbing apparatus in immediate contact with the part to be excavated.

* *Mag. Nat. Hist.*

ON THE BLUE COMPOUNDS OF CYANOGEN AND IRON.*

BY A. W. WILLIAMSON, PH.D.

THE following paper was read before the Chemical Society of London, Mar. 6, 1846.

After referring to the experiments of Gay-Lussac and Berzelius on this subject, the author commences his paper by the examination of the greenish substance, left by the action of sulphuric acid on ferrocyanide of potassium, and shows that it may be regarded as ferrocyanide of potassium, in which one atom of potassium is replaced by iron; it contains one proportion of potassium to two of iron. By the action of diluted nitric acid and heat, this compound is oxidized, assumes a brilliant violet-blue colour, and may be viewed as ferridcyanide of potassium, in which two atoms of potassium are replaced by iron; it contains about one proportion of potassium to 24 of iron. On heating this blue compound, with a solution of yellow prussiate of potash, it changes it to ferridcyanide; and if the blue compound be in mass, no trace of yellow prussiate remains behind. The prussian blue prepared from ferridcyanide of potassium and proto-sulphate of iron is next examined in detail, and also that obtained by the action of oil of vitriol on a solution of ferridcyanide of potassium; the first contains one proportion of potassium to 9·3 of iron, the second one of potassium to about 60 of iron. Dr. Williamson considers that the dyeing power of these blues is in the inverse ratio to their quantity of potassium.

Mr. Warren de la Rue described a new substance he had obtained during his investigation of cochineal, in which he has been engaged some time past; it is analogous to the compound obtained lately by Professor Liebig, by the action of potash on caseine.

* *Chemical Gazette.*

ON THE VENTILATION AND WORKING OF COAL-MINES, WITH A VIEW TO THE PREVENTION OF ACCIDENTS FROM EXPLOSION.

BY PROFESSOR ANSTED.

A LECTURE on the above subject was delivered at the Royal Institution, on the 20th March.

Professor Ansted commenced by alluding to the extent and frequency of the accidents that occur. He then mentioned the position of the coal in beds, and the necessity of sinking deep shafts to obtain it: and alluding to the extent of the workings (often as much as 500 acres) in a single property, he explained that though in the deep mines of the North of England, it was impossible that the number of shafts should be greatly multiplied, still, at least two were required, and ought to be insisted on.

He then stated the principles of coal-working, with reference; 1st, to the tendency of the roof to fall in from pressure; and, 2nd, the necessity of obtaining a current of pure air for the men; and described the different systems followed in various districts with this view. With reference to this part of the subject, he suggested the necessity of the extensive underground works being divided into districts, and provided with separate safe communication; so that, in case of an accident, those only from one district would suffer.

Mr. Ansted then entered on the subject of the gas, and described the singing noise with which it is constantly given off, whenever a fresh surface of coal is exposed. He mentioned also the puffs of gas (blowers) which occasionally burst forth unexpectedly; and stated, that while the ventilation might and ought to get rid of the ordinary issue, no ventilation would suffice to clear the air of these quantities. He instanced the case of a recent explosion at Killingworth, and an accident some years ago at Jarrow, as examples of blowers; and then described the accumulation of gas in old workings, and in the broken roof, or goaf, as other sources of danger. The latter was the cause of the accident at Haswell, in September, 1844.

The methods adopted, either to get rid of the gas or to light the mine, so as to avoid danger, were then alluded to. The advantage of splitting the air into several currents, instead of carrying one current through all the workings, was dwelt upon, and the improved condition of the ventilation of late years, described. With regard to lights, the Davy lamp, with a tin shield was mentioned as, on the whole, the best instrument that could be used, and as safe under all ordinary circumstances.

Referring, then, to the condition of the coal-trade, and the difficulty of having any improvements introduced, or even of getting the best of the acknowledged systems adopted, Professor Ansted dwelt on the necessity of legislative interference; not so much to insist on the adoption of any one plan, as to see that the plans acknowledged to be best were universally carried out. He dwelt especially on the great social duty of looking after and improving the condition of the miner; and concluded by insisting that all mines subject to explosions should be submitted to the inspection of public officers, whose duty should be to see that precautions were taken for the safety of the miner.

REMOVAL OF INSANE PERSONS.

THE following judicious observations on the removal of persons labouring under mental aberration, are extracted from one of a series of valuable lectures on insanity, by Dr. Jno. Conolly, now publishing in the *Lancet*:—

"The comfort of patients in removing is commonly and needlessly neglected by trifling inattentions, such as a want of proper preparation of their wardrobe, their books, or flute, or favourite snuff-box, or cane; and it is much better to avoid even these and all other removable causes of discontent, however insignificant they may appear; for they are not so to the patients. It is generally desirable that the family medical attendant, unless the patient very much dislikes him, should accompany him to the asylum in which he is to be placed, and introduce him respectfully and kindly to the superintendent's notice; that he may feel that he is left in friendly hands, with friendly purposes. The superintendent of every asylum should pay great attention to the ceremonials of admission, and, if possible, never delegate them to others; for the first words addressed by him to his patient are the beginning of his treatment. Every sensitive person knows how materially his comfort as a mere visitor, when going to a strange house, depends on the manner in which he is received, and the same feeling is still more intense in the greater number of insane persons when placed wholly under a stranger's care. They are naturally suspicious of everything, and never mistake conventional politeness for that which springs from sincere sympathy and benevolence. No people distinguish more accurately than the insane between that true politeness which is the expression of the social virtues, and the false politeness which is only the imitation of them. They notice every particularity of manner, voice, and dress, and the appearance of the house and of the attendants; very often, in subsequent conversations, alluding to things said, done, or observed, on the day of their arrival. If they come from an indulgent home, their feelings are easily wounded; and if they come from some other asylum, where they have worn restraints, and suffered insult, hope is revived once more in them by kind words and looks, and by that revival a way is made to break in on many perverse habits nursed by solitude and neglect.

"I suppose it is common to most persons to be extremely sensible of the comforts or discomforts of any new place of residence during the first hours that are passed in it, and to have experienced a feeling of strangeness and loneliness in such circumstances, even when unaccompanied by any cares or causes of depression; and I often refer you to such experiences of mental influences, because in treating maladies of the mind, a knowledge of such influences is indispensable to successful attempts to cure or to relieve the irritation which constitutes so large a part of the malady. You must be able to imagine, then, how a sensitive patient, who has lost sight of the faces of his family, and heard their voices, as he knows, for the last time probably for many months, may be affected, on his arrival, at even the pleasantest and most elegantly arranged asylum. The change may really be the means of his immediate amendment, and of his final recovery; it may be strikingly salutary, even from the first hour: but all depends on the management of this important movement, and on the careful exclusion of all probable causes of distress. A gloomy apartment, doors noisily and ostentatiously locked, windows out of reach or heavily guarded, the prospect of a dismal yard or unweeded garden, dilapidated furniture and shabby finery, negligent cookery and uncleanly service, are all too well calculated to oppress the heart. Still more painful must it be to see other patients with their arms tied up in leather, or their wrists fastened by handcuffs, and to find, as a part of the furniture of the house, any of those disgusting instruments of restraint, called coercion-chairs, even although constructed of elegant materials. The civilized appearance and neatness of the attendants are also points of importance far too much neglected, some of them having often a ruffianly appearance, that it is impossible to mistake; whereas, without good and respectable attendants, of known humanity, no asylum can really be a proper place for the insane, or afford opportunities of recovery."

The difficulty of determining upon the restoration of a patient to a state of sanity is thus commented on.

"One is sometimes asked how it is known that a patient is recovering from a state of insanity. It is, perhaps, best known by our appreciation of numerous slight manifestations, almost defying description, shown in the countenance, manner, speech, and general carriage and demeanour, and often in the dress; just as any person of tolerable observation knows, from various trifling indications, that a man has just drunk a very little too much, or that any one is of a refined or of a vulgar character. An acknowledgment of the previous illness, and the present improvement, is sometimes a satisfactory confirmation; but it is not always an accompaniment even of decided recovery, and it is sometimes one of the

peculiarities of the incurable to make such complacent avowals without real foundation.

"In an asylum so conducted as to shut out all possible causes of disturbance and irritation, some of the incurable patients will conduct themselves in so rational a manner as to lead to a belief that they have become perfectly sane. Conversation with them, and still more, a perusal of their letters, will show the extraordinary discrepancy existing between their ordinary conduct and their habitual thoughts and actual mental state, and reveal delusions and extravagancies which are scarcely credible. In every case of delusion, we should carefully inquire into the tendency of the delusion to suggest actions when the patient is at liberty to do as he likes. Very extreme and absurd delusions may be harmless, and one simple delusion may be dangerous. The question of confinement, or of liberty, wholly turns in these cases on the patient's impressions, and probably consequent actions, being safe or unsafe, or convenient or inconvenient, to himself or to others. I cannot imagine your having much difficulty in deciding on the proper course to be pursued in these cases if you keep this short, simple, and easily-remembered rule in view.

"It is desirable to avoid ambitious and useless attempts to define, by a word, the differences between sanity and insanity; and this may be usefully remembered when we are engaged in investigating cases of supposed or imputed insanity, and in giving evidence concerning them in civil or criminal cases. The medical witness is often keenly cross-questioned respecting his interviews with the supposed lunatic, and, especially, respecting what he said, and what the supposed insane person said; but the fact is, that many insane persons talk without always talking foolishly or madly, and that the manner of saying the commonest things, and the mere aspect of the person suspected, are often quite sufficient to declare the nature of the case, to indicate the disorder, or to manifest the deficiency of the understanding beyond the possibility of doubt.

"The difficulty of determining the time of removing a patient from an asylum is, after all, much greater in some cases than can well be believed by those who have not had extensive opportunities of observation. The object of all treatment is, to restore the patient's power of controlling himself; but I am quite sure that cases occasionally occur in which the completion of treatment is incompatible with the continued confinement of the patient, and his liberation is the last part of the treatment required, and which will confirm the patient's power to control himself when nothing else will do it. I have noticed this more remarkably in female patients of the educated classes of society, and can only ascribe it to their intense perception of the unhappiness of being placed in an asylum, and their ardent desire to go home, and when there, to remain. In some of these cases, when accidental circumstances have caused the removal to take place before it could have been justifiably advised by the physician on ordinary grounds, the result has been very surprising and gratifying. In public asylums for the poor, a physician would scarcely think it right to send away patients on such chances; and in private asylums, the probability of such patients being willingly set at liberty can scarcely be expected. Certain it is, however, that there are some patients who are capable of recovery, and yet who, if kept in an asylum until they are quite well, must be kept there for ever."

REPORT OF EXPERIMENTS ON GUNPOWDER, MADE AT WASHINGTON ARSENAL, IN 1843 and 1844.*

BY CAPTAIN ALFRED MORDECAI, OF THE ORDNANCE DEPARTMENT.

THIS report embodies the results of many thousands of accurate experiments made by Captain Mordecai, under government authority, with instruments constructed in such a manner as to ensure perfect accuracy. Having had the satisfaction of inspecting the instruments, and of hearing from Captain Mordecai an account of the methods of experimenting, we can speak of them with the greater certainty. The force of gunpowder, since the time of Hutton and the French experimenters, has been calculated by means of the balistic pendulum and of a gun pendulum. The gun (in these experiments a 24 and a 32-pounder) is suspended in an iron frame, hung on knife edges of hardened steel, like a balance beam, the whole supported (a load of 10,500 lbs.) on massive stone pillars. The recoil is measured on a limb of brass, having a curve, of which the framework and the gun are the radius, and graduated to read to seconds by means of a vernier which is moved by the recoil, and retained at the point of greatest vibration by a slight spring. When the gun is adjusted and at rest, its axis is a horizontal line, and the vernier stands at zero on the scale.

At a distance of only 55 feet (between the

* *Silliman's Amer. Jour.*

centres) is inserted the pendulum block, for receiving the shot and measuring its velocity. This pendulum is a counterpart to the gun, as regards its mode of suspension and motion, which is also measured in like manner on a graduated arc. This "block," as it is called, resembles a mortar or wide howitzer, with a bore of four and a half feet deep and 15 inches calibre, and filled with leathern bags of sand, and a bedding of lead. This block, the frame and counterpoise weights, weighed 9,358 lbs., and was suspended so as to hang when at rest, with its axis perfectly in one and the same line as the axis of the gun. When prepared for use, the aperture of the pendulum block was covered by a sheet of lead, which served to make the deviation of the ball from a right line, by the hole which was pierced in it. This deviation was found to be very slight.

It seems, to a person unaccustomed to such experiments, a rather daring attempt to fire a 32 lb. shot, at the distance of only 50 feet, in the mouth of another gun. But that velocity which, left unrestrained, would serve to carry the shot for miles, is in this apparatus restrained within the range of a few feet, and imparts only a moderate motion on the great mass of matter on which it impinges, which can be wholly and accurately estimated. Captain Mordecai remarks, that "an observer, placed in such a position as to see the face of the block unobscured by the smoke of the gun, perceives, at the moment of impact, a circle of reddish white flame surrounding the hole made by the ball." He supposes "that this flame may be produced by the combustion of minute particles of iron and lead ignited by friction." He further remarks, that "in firing a 32 lb. ball into the pendulum block with a charge of eight pounds, the sand immediately before the ball was compressed into a solid mass, forming an imperfect sandstone sufficiently firm to bear handling. A specimen is still preserved in that state, after a lapse of more than 18 months." This sand, when examined, was found quite free from any calcareous cement. An apparatus of quite similar structure, on a proportionate scale, was used for muskets. In these experiments, powder from a great number of manufactories, and of great variety of composition, grain, and finish, were tested. The elements for calculating the strength of gunpowder, obtained by these experiments, were resolved by the formulæ of Hutton, and those which more recently have been employed by the French at Metz. This portion of the labour is performed with the accuracy and skill which characterise all the highly educated officers from West Point Academy. Captain Mordecai concludes, from the results of his experiments, that the only reliable mode of proving the strength of gunpowder is to test it, with service charges, in the arms for which it is designed; for which purpose the balistic pendulums are perfectly adapted.

In the 24-pounder gun, new cannon powder should give, with a charge of one-fourth the weight of the ball, an initial velocity of not less than 1,600 feet, to a ball of medium size and windage.

The initial velocity of the musket ball, of 0·05 windage, with a charge of 120 grains, should be

With new musket powder not less than ..... 1,500 feet.
With new rifle ditto ..... 1,600 ,,
With fine sporting ditto ..... 1,800 ,,

The common eprouvettes are of no value as instruments for determinating the relative force of different kinds of gunpowder.

The proportion used in making our best powder, 76.14.10, and the English 75.15.10, appear to be favourable to the strength of powder. The best mode of manufacture is in what is called the cylinder mills under heavy rollers, and this process alone is considered capable of making good sporting powder. The English have employed this process for fifty years, but the French still use the old method, by stamping or pounding. The "gravimetric density" should not be less than 850, nor more than 920. The charge for cannon for all ordinary purposes should be one-fourth. No purpose, even breaching a battery, requires more than one-third the weight of the ball. For small arms the following charges are proposed: for the percussion musket, 110 grains; the percussion rifle, 75 grains; the percussion pistol, 30 grains of rifle powder. It is proposed that musket and rifle balls should be made by compression, instead of casting, as at present.

CONVEYANCE OF SEEDS AND CUTTINGS.

In the "Journal of the Horticultural Society," detailing the results of the growth of bulbs transmitted from India, and sent from the India House to the gardens of the Society, and of which one-half was packed in cotton, and the other enveloped with wax, it is shown that the latter, though they had been confined in the wax for three months, appeared quite firm and fresh, and though they did not move for a month, yet afterwards grew strong and healthy; while those sent in cotton and brown paper had grown considerably in their transit, and when

potted, grew first, but soon displayed symptoms of debility.

The above experiments originated in the successful results which attended the transmission of some seeds similarly enveloped in wax from the India House to different parts of India. Though the mails give great facilities for the transmission of such things as far as the shores of that country, yet it is not an easy matter to send them across the length and breadth of India in the different seasons of the year, the country being at one time inundated with rain, at another scorched up with heat, and having only a few months of comparatively moderate weather. In the moist weather, roots, seeds, &c. are apt to be rotted, and in the hot weather, parched up. Caoutchouc cloth forms a good protection against external moisture, but equally prevents the escape of any that is enclosed, and that is apt to be the case with things packed up in the rainy season. Cotton in this case is useful in absorbing moisture, but is objectionable for this very reason in dry weather, though having the advantage of being a bad conductor of heat.

The idea of enveloping some seeds and bulbs in wax originated in the difficulty of sending such seeds as the Spanish chesnut and the filbert, which it was desirable to introduce into the Himalayas. Of the chesnuts, all those at first sent were either dried up, or completely decayed. It appeared that if they could be hermetically sealed up, there seemed no good reason why they should not arrive in good order, even in the most distant parts of India. A thick coating of gum was first thought of; but it did not answer at first, from being too diluted. We know not why if seeds are stuck into a thick mucilage and allowed to dry, it should not answer. Wax, just a little melted, was then tried, and with complete success in repeated attempts. The chesnuts and filberts were described as arriving at Bombay, Calcutta, and Saharunpore, in a perfectly sweet and fresh state. Both vegetated, and those sent to the Saharunpore Botanical Garden are now growing in the Himalayan Mountains. The wax has also been employed for enveloping the ends of cuttings of fruit-trees, which have also arrived in a living state; so much so, that apples, pears and plums sent in this way are now about three feet high in the same locality; and no doubt they will bear fruit there, as a Ribstone pippin introduced about the year 1828 from Liverpool, bears very fine fruit, and was this year covered with thousands of apples. The above facts may be useful to some of our readers in conveying to a distance seeds and bulbs which are difficult of transmission.

ADAPTATION OF THE EYE TO DISTINCT VISION AT DIFFERENT DISTANCES.

BY PROF. FORBES.

The crystalline lens—for example, that of the ox—is composed of a nearly spherical nucleus of compact, comparatively dense, matter, of a hard pasty consistence; this nucleus gradually, yet rapidly passes into the gelatinous envelope, of a lenticular form, which has far less consistence and less resistance to external pressure, than the central spherule. Prof. Forbes thence suggests that any uniform pressure applied to the lens, such as might be communicated by the external muscles of the eye to the entire eyeball, and propagated by hydrostatic pressure through the humours, would tend to make the exceedingly flattened ellipsoid of the eye approach in figure to the dense spheroidal nucleus; the obvious effect of this would be, to increase the curvature of the lens without changing its position, and thus render the rays from a near object more convergent. The effect probably proceeds from a simultaneous effort of the four *recti* muscles drawing the eye back in its socket.

NOTICES TO CORRESPONDENTS.

"O. P. Q." (Daventry.)—We are not acquainted with the composition of the "Succedaneum," but there can be little doubt it is merely a modification of the well-known fusible alloys produced by the combinations of bismuth, lead, and tin, sometimes mercury, when it is required to have an alloy fusible at a very low degree of temperature. How any substance of this nature can be prepared, so as to be applied without the intervention of heat or moisture, we cannot see.

"W. M." (Hastings.)—We are sorry we cannot give our correspondent so definite an answer as we could wish, before our next number appears; but his question shall not be lost sight of.

Received "Three Reports, by the joint deputation of the Society of Apothecaries and the National Association of General Practitioners, on the subject of the incorporation of the General Practitioners in Medicine, Surgery, and Midwifery."

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month. Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

EXPERIMENTS ON THE CHLORIC ETHERS.*

BY M. MALAGUTI.

A long and excellent treatise on chloric ethers has been recently published in the *Annales de Chimie et de Physique*, by M. Malaguti. This work forms the continuation of the experiments recorded some years back by this learned chemist, on other ethers of the same nature, and particularly on chloroxalic ether.

M. Malaguti has divided his work into two parts; the first is particularly devoted to the study of the reactions of perchlorated ether, the second contains the history of several compound chlorated ethers.

I. PERCHLORATED ETHER.

$(C^4\ Cl^{10}\ O.)$

M. Malaguti has made many new and extremely interesting observations on this body, which, as we know, was discovered by M. Regnault. When chlorine is allowed to pass, under the influence of the sun's rays, through common ether, $C^4\ H^{10}\ O$, we often obtain, instead of perchlorated ether, the sesquichloride of carbon, $C^2\ Cl^6$: this is because the perchlorated ether can be of its own accord converted into this last body; but it is not as we might be tempted to believe, caused by the displacement of oxygen by the chlorine. (By doubling the formula $C^2\ Cl^6$, we have $C^4\ Cl^{10}$, in which Cl^2 replaces the oxygen of the perchlorated ether.) M. Malaguti has discovered that perchlorated ether can be reduced to

$$C^2\ Cl^6 + C^2\ Cl^4\ O,$$

that is to say, into sesquichloride of carbon and another liquid and fuming body, which always accompanies the latter, and which can be obtained by slowly distilling the product of the action of chlorine on ether.

This liquid is a new substance, whose properties and composition M. Malaguti has carefully determined. M. Malaguti has also shown that perchlorated ether boils at 572° F., and is decomposed, in a very striking manner, into sesquichloride of carbon, and this fuming liquid—chlorated aldehyd—which we shall presently describe; the author has perfectly studied this reaction by the assistance of analysis.

Dry chlorine, at the temperature of 312° F., under the influence of the solar light, has no action on perchlorated ether.

Potash acts upon it at about 572° F., causing a violent detonation, even when we operate on small quantities.

Hydrochloric and nitric acid do not act upon it; but hot concentrated sulphuric acid attacks it, producing chlorated aldehyd and hydrochloric acid.

Ammonia has no action on perchlorated ether.

Potash, dissolved in alcohol, has little action on it; but the monosulphuret of potassium attacks it in a very decided manner: a chloride is produced, sulphur deposited, and we obtain a new body *chloroxéthose*, in which we discover

$$C^4\ Cl^{10}\ O + 2K^2\ S = 4K\ Cl + S^2 + C^4\ Cl^6\ O.$$

CHLORATED ALDEHYD, PRODUCED BY THE DECOMPOSITION OF PERCHLORATED ETHER.

$(C^2\ Cl^4\ O.)$

When in the greatest state of purity, this body is a limpid, colourless liquid, fuming and reddening moist turnsole paper. When placed on the tip of the tongue it produces a strong sensation of dryness, then a smarting pain, and the part touched becomes white.

It boils at 244° F. In a liquid state, its specific gravity is 1·608 at 64° F.; in the state of vapour, its specific gravity was found to be equal to 6·320, which corresponds with two volumes, for the formula mentioned.

Poured into water it falls to the bottom, but it is dissolved by degrees, and the solution then contains hydrochloric acid and chloracetic acid—

$$C^2\ Cl^4O + H^2O = H\ Cl + [C^2\ (HCl^3)\ O^2]$$

When a small quantity of alcohol is poured over chlorated aldehyd, the temperature is

* *Journal de Pharmacie.*

raised to such a degree, that the whole mass boils, and, if not quickly cooled, it is converted into vapour; but if, on the contrary, we pour chlorated aldehyd, by degrees, into a certain quantity of alcohol, the re-action is more gentle, and the temperature is scarcely raised; when water is added to the alcoholic liquid, an oil separates, which presents us with the composition and all the properties of acetic ether: in other words we have—

$C^2Cl^4\,O + C^2H^6O = H\,Cl + [C^4\,(H^5\,Cl^3)\,O^2]$

Placed in contact with gaseous or liquid ammonia, chlorated aldehyd, immediately becomes solid, with the disengagement of heat, producing sal ammoniac, and a peculiar amide, chloracetamide, which has been extracted by the ether, the reaction is the same as with water and alcohol—

$C^2\,Cl^4O + N\,H^3\,O = H\,Cl + C^2\,Cl^3\,H^2\,N\,O.$

CHLOROXETHOSE PRODUCED BY THE ACTION OF MONO-SULPHURET OF POTASSIUM ON PERCHLORATED ETHER.

$(C^8\,Cl^6\,O)$.

When we heat a mixture consisting of an alcoholic solution of monosulphuret of potassium, and perchlorated ether, a chloride is deposited, the liquid become perceptibly darker, and, if we leave the product at rest, we find it on the following day of a golden yellow colour, at the same time the deposit of chloride is covered with crystals of sulphur. If we then add water to the liquid, a yellowish oil is separated, which is chloroxethose.

M. Malaguti recommends the employment, for this composition, of 50 parts of of monosulphuret of potash, 16 parts of perchlorated ether, and 200 parts of alcohol, at 203° F. If the product still contains perchlorated ether, it is necessary to submit it again to the action of the sulphuret.

Chloroxethose is limpid and colourless, and of a very agreeable odour, reminding one of the meadow-sweet (Spiræa ulmifolia), and of a sugary taste. The density, determined at 68° F. is equal to 1·654, it boils at 410° F., and is partially decomposed.

Air decomposes it after a time. Alkalies and common nitric acid do not affect it, but hot nitric acid, at 1·5, has an energetic action, to a great extent decomposing it.

If we expose chloroxethose to the sun's light, in an atmosphere of dry chlorine, we perceive, after a few days, crystals of perchlorated ether appear.

$C^4\,Cl^6O + Cl^4 = C^4\,Cl^{10}\,O.$

If chloroxethose be placed in water hydrochloric acid and chloracatic acid are produced at the same time; or otherwise—

$C^8\,Cl^{10}\,O + 3\,H^2\,O = 4\,H\,Cl + 2\,[C^2\,(H\,Cl^2)\,O^2].$

We see that chloroxethose comports itself like chloride of carbon, $C^2\,Cl^4$—the chlorethose of M. Malaguti—under the influence of chlorine; in this case perchlorated ether, chloride of chloroxethose M. corresponds with sesquichloride of carbon—chloride of chlorethose M.—which as we know, is also acted on by monosulphuret of potassium, in losing its chlorine.

BROMIDE OF CHLOROXETHOSE, THE PRODUCT OF THE ACTION OF BROMINE ON CHLOROXETHOSE.

The analogy that exists between the nature of perchlorated ether, and sesquichloride of carbon, is also manifested in other reactions.

If we expose chloride of carbon $C^2\,Cl^4$, in contact with bromine, to the direct action of light, at the end of a few instants the mass becomes solid, and crystallises. When we treat this product with alcohol we obtain small prismatic crystals, having the same form as those of sesquichloride of carbon. They are slightly aromatic, their density, at 70° F., is 2·3. They begin to be volatile at about 312° F., and are decomposed into bromine and chloride of carbon $C^2\,Cl^4$. Treated with sulphuret of potassium, they again set at liberty the chloride, producing bromide of potassium. Analysis has proved that this new combination of bromine is no other than $C^2\,Cl^4 + Br^2$, that is to say, sesquichloride of carbon, in which, Cl^2, are replaced, by Br^2; M. Malaguti calls it bromide of chlorethose.

Chloroxethose comports itself with bromine in the same manner as chlorethose or chloride of carbon, $C^2\,Cl^4$; exposed to the action of the sun, along with bromine, it yields crystals of the same form as those of perchlorated ether, but containing $C^4\,Cl^6 + Br^4$.

These crystals are colourless and in odourous, melting at 205° F., and decomposing at 356° F. into bromine and chloroxethose; by the action of monosulphuret of potassium, they set chloroxethose at liberty, and form a bromide. This bromide of chloroxethose is evidently the equivalent of perchlorated ether, or chloride of chloroxethose; it is, however, distinguished, as we shall see, by the manner in which it comports itself at a high temperature.

II. COMPOUND PERCHLORATED ETHERS.

M. Malaguti has studied, comparatively, chlorocarbonic ether, $C^5\,Cl^{10}\,O^2$, chloroxalic ether, $C^6\,Cl^{10}\,O^4$, perchloracetic ether, $C^4\,Cl^8\,O^2$, and chlorosuccinic ether, $C^8\,(Cl^8\,H)\,O^4$; he submitted these bodies to the action of four agents, namely, alcohol, potash, ammonia and heat.

CHLOROCARBONIC ETHER.

This body, which was discovered by M. Cahours, melts between 187° and 191° F., it thickens between 145° and 149° F., and like chloroxalic ether, it has a family resemblance not easily mistaken; it does not, however, comport itself in the same manner in various reactions. Dissolved in alcohol, chlorocarbonic ether is converted into an oil, which is merely a mixture of normal carbonic ether and chloracetic ether. At the same time, a considerable quantity of hydrochloric acid is formed—

$$C^6\ Cl^{10}\ O^3 + 4\ C^2\ H^6\ O = C^6\ H^{10}\ O^3 + 2\ [C^4\ (H^5\ Cl^2)\ O^2] + 4\ H\ Cl.$$

When we heat chlorocarbonic ether in a potash ley, a very brisk reaction is established, and we obtain a carbonate, a formiate, and a chloride—

$$C^6\ Cl^{10}\ O^3 + 10\ H^2\ O = 3\ C\ H^2\ O^2 + 2\ C\ H^2\ O^2 + 10\ H\ Cl.$$

M. Malaguti imagined, that the formiate might perhaps be a secondary product, arising from the chloracetic acid, which once formed, might be decomposed by an excess of potash. Still however he was not able to observe the formation of the least trace of chloroform.

Heated in ammoniacal gas, chlorocarbonic ether acts briskly on it, and a mass is produced spotted with small acicular crystals, and glittering tablets, which we treat with anhydrous ether. This last, extracts a peculiar substance, which is deposited by the spontaneous evaporation of the menstruum; we crystallise it in boiling water, and if necessary, with the addition of a small quantity of animal charcoal, until it is obtained under the form of extremely white blades resembling the leaves of fern, and possessing a decidedly sweet taste. Repeated crystallisations are necessary for the purification of this substance, a considerable quantity, however, is lost in the process.

This substance is a peculiar amide, to which M. Malaguti has given the name of *chlocarbéthamide*. It melts between 280° and 284° F. At about 428°, it begins to turn brown, and boils at a heat exceeding 500°. If quickly heated it rises in a vapour which is condensed under the form of shining and iridescent pallets. Pounded, when cold, along with lime, it does not give out ammonia, but it yields a considerable quantity when boiled in an alkaline solution. Left at rest for some time in liquid ammonia, it is dissolved, and transformed into a crystallisable salt of ammonia. It is extremely soluble in alcohol and ether, but to a small extent only in cold water.

M. Malaguti represents this body by the formula $C^{10}\ H^{12}\ Cl^{14}\ N^6\ O^3$.

The formation of this body is accompanied by that of a large quantity of sal-ammoniac. We cannot place this amide in comparison with chlorocarbonic ether and ammonia, but M. Malaguti believes that it is connected with the simultaneous formation of a peculiar salt of ammonia, that remains in the mother liquids in the preparation of the amide, and which he has not been able to separate.

When the above amide is digested in liquid ammonia, it disappears by degrees, and the solution, when left at rest, in a vacuum, yields a quantity of white pallets, greasy to the touch, extremely bitter, and readily soluble in water, alcohol and ether. This salt M. Malaguti calls *chlocarbethamate of ammonia*; it melts between 95° and 98° F., and disengages a quantity of ammonia, when pounded along with lime; it contains

$$C^{10}\ H^{12}\ Cl^{14}\ N^3\ O^9\ 4\ N\ H^3.$$

It is formed, therefore, by the fixation of 6 equivalents of water in the chlocarbethamide. Two-thirds of the nitrogen is met with under the form of ammonia, as proved by experiment. M. Malaguti, however, has been unable to separate the acid.

The action of liquid ammonia on chlorocarbonic ether is still more complicated than that of ammoniacal gas, for it acts, at the same time, as an amidogenic body; and an alkali. When we pour chlorocarbonic ether into ammonia, we hear a hissing sound, like that produced by plunging heated iron in water, and chlocarbethamide, carbonate, and formiate of ammoniac, sal-ammoniac, and other chlorated ammoniacal salts are produced, among which chlocarbethamate must necessarily be met with.

The action of heat, alone, on chlorocarbonic ether is extremely simple, the substance is partially distilled without change, and partly decomposed into carbonic acid, chlorated aldehyd, and sesquichloride of carbon; or

$$C^6\ Cl^{10}\ O^3 = C\ O^2 + C^2\ Cl^4\ O + C^2\ Cl^6.$$

CHLOROXALIC ETHER.

This body had already been examined by M. Malaguti on a former occasion; his new memoir completes his work by several reactions.

Submitted to the action of potash chloroxalic ether yields an oxalate, a chloracetate, and a chlorid —

$$C^6\ Cl^{10}\ O^4 + 4\ H^2\ O^4 = C^2\ H^2\ O^4 + 2\ [C^2\ (H\ Cl^2)\ O^2] + H\ Cl.$$

The chloracetate is decomposed, when boiled with potash, into a formiate and chloroform, which passes into an oily state.

Ammonia converts it into two amides, one of which, chloroxamethane has, alone, been capable of analysis, and was already described

in M. Malaguti's last work; at the same time salts, or a salt, of ammonia is produced, in addition to sal-ammoniac. It is a fact worthy of notice, that chloroxamethane, when perfectly pure, does not produce an oxalate by the action of the alkalies; there is therefore no analogy, except that of composition, between chloroxamethane and oxamethane.

Finally, M. Malaguti also proved the presence of chloracetic acid among the products resulting from the action of alcohol on chloroxalic ether.

When rapidly distilled, several times in succession, chloroxalic ether is completely converted into phowene, oxide of carbon, and chlorated aldehydsg

$$C^6\ Cl^{10}\ O^4 = C\ O\ Cl + C\ O + 2\ C^2\ Cl^4\ O.$$

After a lapse of time, chloroxalic ether, enclosed in a phial, appeared to undergo the same metamorphosis as if it had been subjected to heat.

All these reactions were studied by M. Malaguti with the greatest care.

PERCHLORACETIC ETHER.

Before he examined the reactions peculiar to this ether, M. Malaguti studied those of chloracetic ether.

When we leave the latter for about twenty or thirty minutes in contact with liquid ammonia, a crystalline mass is produced, which, when crystallised in boiling water, yields beautiful rectangular laminæ of a new amide.

CHLORACETAMIDE.

This body is transparent, sweet and fusible at 275° F., but little soluble in cold water, but extremely so in alcohol and ether. Once melted, it begins to turn brown at from 460° to 472° F. Pounded along with hydrate of lime, it does not disengage ammonia, but it gives it out when boiled in a potash ley. Digested for some time in ammonia, chloracetamide is finally dissolved, and the solution, carefully evaporated, yields beautiful transparent crystals of chloracetate of ammonia.

The chloracetamide contains

$$C^2\ H^2\ Cl^2\ N\ O;$$

and is therefore formed in the following manner:—

$$C^4\ (H^6\ Cl^2)\ O^2 + N\ H^3 = C^2\ H^6\ O + C^2\ H^2\ Cl^2\ N\ O.$$

We do not obtain chloracetamide by the dry distillation of chloracetate of ammonia. The decomposition of this salt by means of heat presents two phases, one of which is represented by watery fusion, and the other by igneous fusion. In the first case the hydrated chloracetate of ammonia is decomposed into chloroform and carbonate of ammonia; in the second the anhydrous salt is converted into sal-ammoniac, phosgene, and oxide of carbon. This decomposition agrees with that noticed by M. Kolbe in the case of the metallic chloracetates.

We have seen above, that chloracetamide may be obtained by other means. M. Cloez prepared it by the action of ammonia on chloroformic ether; according to M. Malaguti the most abundant source of this body is perchloracetic ether.

Let us now examine the reactions observed by M. Malaguti in the case of this last ether.

Mixed with pure alcohol, perchloracetic ether becomes much heated, and is completely converted into hydrochloric acid and chloracetic ether—

$$C^4\ Cl^8\ O^2 + 2\ C^2\ H^6\ O = 2\ H\ Cl + [C^4\ (H^6\ Cl^2)\ O^2].$$

According to the experiments of M. F. Leblanc, potash decomposes perchloracetic ether into a chloracetate and chloride; he omits saying, that by causing it to boil we also obtain the products of the decomposition of chloracetate.

Ammonia, either liquid or in a gaseous state, acts energetically on perchloracetic ether, producing sal-ammoniac and chloracetamide—

$$C^4\ Cl^8\ O^2 + 2\ N\ H^3 = 2\ [H\ Cl + C^2\ H^2\ Cl^2\ N\ O].$$

Subjected to the action of heat, perchloracetic ether is converted into a fuming liquid, which is no other than chlorated aldehyd; in this case the perchloratetic ether is converted into an isomerous body—

$$C^4\ Cl^8\ O^2 = 2\ C^2\ Cl^4\ O.$$

This transformation had been previously suspected by M. F. Leblanc; when wishing to determine the density of the vapour of perchloracetic ether, he found it to be much weaker than that indicated by calculation.

The isomery of perchloracetic ether and chlorated aldehyd, is a rare instance, in organic chemistry, of two bodies of entirely different origin, partaking of the same chemical properties, and only differing from each other by their density and their boiling point.

CHLOROSUCCINIC ETHER.

Of all the perchlorated ethers, chlorosuccinic ether is the only instance in which we still admit the presence of hydrogen.

It does not dissolve in alcohol, without the assistance of heat; as soon as it is completely dissolved, it is no longer possible to remove the minutest quantity. The whole is decomposed, and transformed into an oil, that water can set at liberty, and which is only a mixture of chloracetic ether, carbonic

ether, and the ether of a new acid, which M. Malaguti calls *chlorosuccic acid.*

This last is extremely acid and crystallisable. It melts at 140° F., becomes volatile by heat, and condenses under the form of extremely slender, silky prisms. Its diluted solution does not become cloudy by the addition of nitrate of silver; but, if itis concentrated, it immediately produces a crystalline mass, formed of small and very brilliant prisms, when cold, scarcely sensible to the action of light, but extremely so with the aid of heat. No salt precipitates the diluted solution of this acid, even when saturated with ammonia; its ammoniacal salt crystallises in fibres, resembling asbestos, and it is not deliquescent; M. Malaguti discovered in it

$$C^6 (H^4 Cl^6) O^8.$$

And in the salt of silver—

$$C^6 (H^2 Ag^2 Cl^6) O^6.$$

The action of alcoho on chlorosuccinic ether, may, therefore, be expressed by the following equation :—

Carbonic Ether. Chloracetic Ether.

$$2 [C^8 (H Cl^{12}) O^4] + 2 [C^5 H^{10} O^2] + 4 C^4 (H^5 Cl^3) O^2] + [C^{10} (H^{12} 2 Cl^6) O^8] = 8 H Cl + H O.]$$

Chlorosuccinic ether only differs from chlorocarbonic ether by the elements [C^3 (Cl^3 H) O] which the first contains, in addition; alcohol, in fact, acts on chlorosuccinic ether as if it was in the presence of chlorocarbonic ether, or of a similar body.

Chlorosuc. Ether.

$$[C^3(Cl^3H)O] + 2C^2 H^4 O = [C^{10} (H^{12}Cl^6)O^3] = H^2 O.$$

M. Malaguti calls these complimentary elements of chlorocarbonic ether chlorosuccide, they return in all the metamorphoses of chlorosuccinic ether, and the adoption of which, according to M. Malaguti, much assists the understanding of the subject.

When we heat chlorosuccinic ether with a potash ley, the reaction is brisk; all the ether disappears, and a chloride, a carbonate, a formiate, as well as a chlrosuccinate, is formed.

$$2[C^8 (H Cl^{12}) O^4] + 21 H^2 O = 6 C H^2 O^3 + 4 C H^2 O^2 + [C^6 (H^4 Cl^6) O^8] + 20 H Cl.$$

When we direct dry ammoniacal gas upon chlorosuccinic ether, in powder, the mass becomes much heated, and the product, treated by sulphuric ether, yields to it, a mixture of chlorocarbethamide which may be obtained pure by distillation in boiling water.

The ammoniacal salt dissolved in cold water, is decomposed by hydrochloric acid; it also precipitates an oil which immediately crystallises. This product is a nitrated acid, crystallising in four-sided prisms, terminated by pyramids, decomposing the carbonates, and of an extremely bitter taste; almost insoluble in water, and extremely soluble in alcohol and ether, it melts in water at from 181° to 185° F., and in the air at 392°; but it has already sublimed at 257°; and it turns yellow at 482°.

This acid, which Malaguti calls chlorazosuccic, gives, when in a concentrated solution, and saturated with ammonia, the following reactions :—It produces a lilac-coloured precipitate with the salts of copper, a white crystalline deposit with salts of lime, white and amorphous with the salts of silver and mercury: it produces no precipitate in the solutions of chloride of barium, sulphate of magnesia, sulphate of manganese, and sulphate of zinc. M. Malaguti represents it by $C^6 Cl^6 H^2 N^2 O^2$.

The chlorazosuccate of ammonia is first decomposed in the water-bath, with strong effervescence, the residue, treated with sulphuric ether, leaves a considerable quantity of sal-ammoniac, and yields up to the solvent a peculiar substance, which crystallises in boiling water, in long prismatic needles, colourless, and extremely soluble in alcohol and ether, fusible between 187° and 178° F., volatile without decomposition, giving out no ammonia by their contact with cold hydrated alkalies, but yielding a considerable quantity of ammonia when boiled with these agents. It is therefore a new amide, which Malaguti represents by $C^4 H^4 Cl^4 N^2 O$, and he calls it *chlorosuccilamide.* When considering this composition, we observe, that the amide was formed from the chlorazosuccate of ammonia, by the simultaneous elimination of sal-ammoniac and a gaseous mixture of C O and C O^2; M. Malaguti being unable to operate on a small quantity of matter, was only able to prove the disengagement of carbonic acid.

Be it how it may, the immediate action of liquid ammonia on chlorosuccinic ether, reminds one of the same agent with chlorocarbonic ether. The only difference consists in the formation of chlorazosuccate of ammonia, at the expense of the complimentary elements called by M. Malaguti chlorosuccide.

As to the action of liquid ammonia it is the same as that of ammoniacal gas.

Finally, the action of heat on chlorosuccinic ether, also resembles that of chloro-

carbonic ether. By distilling the first at 576° F., it disengages C O², and it passes over a dense oil containing chlorated aldehyd, sesquichloride of carbon, as well as a third liquid which is converted by water, after a time, into chlorosuccic acid, and which, consequently, appears to be chlorosuccide—

$$C^8 (H Cl^{12}) O^4 = C O^2 + C^2 Cl^6 + [C^3 (Cl^3 H) O] + C^2 Cl^4 O.$$

We see that the history of chlorosuccinic ether is an exact repetition of that of chlorocarbonic ether, with the addition of the phenomena having reference to chlorosuccide.

The curious decomposition presented by chlorosuccinic ether, induced M. Malaguti to treat other ethers formed by polybasic ethers, with chlorine; but he was unable to procure any well-defined bodies, at least by operations on adipic and aconitic ether.

A LETTER, ADDRESSED TO BARON LIEBIG, PROFESSOR AT THE UNIVERSITY OF GIESSEN, (G. D. OF HESSE.)*

BY MM. LAURENT AND GERHARDT.

"Monsieur le Baron—You have just published a brochure, in which you have attacked our labours in the most injurious manner.

"You are at liberty, doubtless, to find our labours to be bad, and you may also attack us in a style at which any well-bred man would blush; you alone are responsible for your own expressions.

"But you have no right to calumniate us; you have no right to designate us forgers, highway robbers, to say, in the face of the world, that in order to refute your theories, to expose your errors, we have deceived the Academy of Sciences, in presenting to that body, on the 22nd of September last, experiments which do not exist, which we never made.

"Were you a Frenchman, Monsieur le Baron, we might call you to account for these calumnies, before the legal tribunals, for those experiments were made in Paris, in the laboratory of M. Pelouze, for the most part in the presence of M. Pelouze, or his pupils, and upon substances furnished by that chemist, and also in Montpelier, in the laboratory of the Faculty of Sciences, partly with materials furnished by M. Pelouze, and partly on products prepared in the latter laboratory, and which were shown to many persons, amongst others to the Dean of the Faculty.

"This will serve to show the value of your assertions.

"Since your being a foreigner insures your impunity, we have no other resource against you than an appeal to public opinion; we beg you, therefore, Monsieur le Baron, to have the goodness to give our reclamation its right, by retracting your words, and to accept our *salutations empressées*.

"Aug. Laurent,
"Corresponding Member of the Academy of Sciences.

Ch. Gerhardt,
"Professor to the Faculty of Sciences, Montpelier."

In publishing this letter in his journal, *The Annalen*, Baron Liebig tells us, the authors have sent no less than six copies, to be placed in a public reading-room at Giessen, besides very liberally distributing copies of it elsewhere; he says, "I think proper to accompany this letter with a few remarks."

It will be immediately perceived that the authors of this letter have only tried to refute one point of my article on M. Gerhardt and his relation to organic chemistry. Their object is to prove, *by witnesses*, that the statements they communicated to the Academy, in their letter of the 22nd of September, last year, are the results of experiments really instituted. By the addition of his name, M. Laurent has incurred part of the responsibility of these statements; and I think I am not deceived if I say that the only object of the reclamation is his justification.

The statements contained in the communication of the 22nd of September, 1845, correspond, however, word for word, with the note laid before the Academy in January, 1844, (*Comptes Rendus*, p. 158,) therefore two years ago; they are exactly those which he endeavoured to maintain in January, 1845, (*Comptes Rendus*, p. 27,) when he declared that he, as well as two other very well-known chemists, had not succeeded in obtaining mellonide of potassium.

There can, I should think, be no doubt that the formulæ which M. Gerhardt gave in July, 1844, and in January, 1845, as the composition of the mellon compounds, only express his own opinions, and are not by any means the results of experiments made by himself; and the complete manner in which his statements of the 22nd of September, 1845, correspond with his former ones, seemed to leave no doubt as to their being of the same origin.

The contents of the note of the 22nd of

* *Lancet.*

September, in which M. Laurent bore a part, by adding his name, turn upon the refutation of two principal points. It is said that I asserted—1st, that mellonide of potassium is produced by dissolving mellon in potassium; 2ndly, that hydromellonic acid is decomposed by heat into mellon and hydrogen. Both of these things are impossible according to the views which MM. Gerhardt and Laurent have taken of the composition of the mellon compounds. These two assertions are contradicted in their note, and the Academy is made acquainted with the error which I have committed. "It is impossible," say MM. Gerhardt and Laurent, "to conceive, according to this, the formation of mellonide of potassium out of mellon with potassa: we have, besides this, no example of such an extraordinary reaction as hydromellonic acid affords by heat."

If I now maintained that the Academy has been deceived by Messrs. Gerhardt and Laurent, I believe I have an indisputable right to do so, as the assertions which they attributed to me are false, and were never made by me. I have never maintained that mellonide of potassium may be prepared by the solution of mellon in potash; on the contrary, I have shown and described circumstantially, (*Ann. de Chimie et de Phys.*, p. 55,) that there is formed, under these circumstances, a salt of a strong alkaline reaction, the acid of which in the silver salt contains 1·11 per cent. of hydrogen, and 22·18 per cent. of oxygen.

I have never asserted or maintained that the so-called hydromellonic acid is decomposed by heat into mellon and hydrogen.

The statements of Messrs. Gerhardt and Laurent could therefore have no other object than to lead the Academy astray in their judgment. I say, they could have no other motive, because I have, with a perseverance which scarcely any other chemist would have exercised, endeavoured, although altogether without success, to correct their error a year before.

After I had read M. Gerhardt's note, addressed to the Academy in January, 1844, wherein these assertions first appeared, I determined to repeat my labours on mellon and its compounds. This investigation presented great difficulties, and it cost me three months labour to discover a good method for making mellonide of potassium, and to determine the composition of the mellon compounds. Theory and theoretical speculations were not at all questions in my labours, (*Ann. de Chem. et Pharm.* vol. 1, s. 338,) as they consist of a series of results expressed in figures. What sentiments I then entertained may be judged of by the paper itself, where, at page 344, I said, "If before describing my own experiments, I have said nothing more of the labours and results of others (Volkel's and Gerhardt's) which are opposed to the existence of mellon itself, or to its nature as a compound radical, than that I have read them, it is only because I think that they will be refuted in the following details:—

This hint, which might, to any impartial person, serve to prove that I sought to correct mistakes in the most forbearing manner, and wished to avoid a dispute, failed to accomplish its object. Even when, after some months, there appeared an absurd, contradictory, and totally false interpretation of my experiments from the pen of M. Gerhardt, in his *Comptes Rendus mensuels*, (January, 1845,) I forebore saying anything; but when, in September of the same year, the same inventions and false assertions reappeared in the circle of the Academy, and were discussed in their original construction, there could not possibly be any more doubt as to the intention and object of these attacks; and no one will blame me if I expressed myself with the full indignation which such proceedings must excite.

The proofs that they have worked upon the mellon compounds, to which MM. Gerhardt and Laurent allude in their letter to me, in themselves say nothing, and are worthless, because they do not demonstrate that they really analysed mellon combinations, I do not doubt that they have instituted analyses in M. Pelouse's laboratory of substances, which they took for mellonide of potassium; but who would give to such proceedings the name of an investigation, and ascribe to them the character of demonstration, as they have done? Five months have now elapsed since the 22nd of September, 1845, and neither of these two chemists has ever published any result in figures of this analysis, which might make it possible for other chemists to judge of the correctness of their statements. Are these not sufficient grounds to make one believe that the statements of the 22nd of September, 1845, rest upon the same basis as the two preceding ones, which correspond literally with these, and are not founded upon experiments and analyses, and for which no reclamation is made?

Nothing is certainly more convenient than this kind of refutation by the analysis of substances, which they might, in case of need, have obtained as good, and perhaps even much better, at that excellent manufactory of chemical products which bears

the honourable name of M. Roubiquet. It often happens that my assistants make combustions of organic substances for me, because the time that I spend in my laboratory in teaching, is much too valuable for me to perform operations with which my assistants are perfectly acquainted; but I should never dream of valuing in the least, or of publishing an analysis, of a substance which I had not prepared with my own hands. For these preparations there are necessary a number of experiments, and an expenditure of time, exceeding often a hundred-fold that spent upon an analysis. Thus I may give an instance: that merely in order to find a secure method of preparing glycocoll, (gelatine sugar,) and to be able to confirm one of the most important facts for animal chemistry—namely, the division of hippuric acid into benzoic acid and glycocoll, described by Dessaignes (a statement which was perfectly correct), I had to perform, necessarily, a series of experiments, which occupied me unceasingly for six weeks. How can the difficulties of such an undertaking be compared to the performance of an organic analysis? If, however, the method is once found, then a number of young chemists are sufficiently clever and experienced to finish the work, which for them becomes a source of instruction.

I repeat, that I should never have thought it worth while to bring to public discussion the manner in which M. Gerhardt mutilates the labours of foreign chemists, and turns them to his own use, had not he known how to attain the confidence of the editors of one of the best French journals, and to induce them to spread through a large circulation his false and unconscientious statements. If the editors of this journal would, for example, take the trouble to compare the extract of the investigations of MM. Merklein and Wöhler on bezoaric acid, which M. Gerhardt gave in the last number of the journal, with the original paper, they would once for all be deterred from making M. Gerhardt's views their own, as they have done in combining from this time the *Comptes Rendus* of M. Gerhardt's with their own journal. All that Wöhler states of the imperfect knowledge of glauco-melanic acid is given by M. Gerhardt as his idea, as his critical judgment, so that the reader of this extract might be led to consider the authors as unskilful beginners.

Another artifice of M. Gerhardt's is, that he mentions nothing in the above article of what Wöhler has said upon the evident connexion of bezoaric, gallic, and tannic acids, instead of which he, however, describes the reactions that M. Wöhler gives, as proofs of his conclusions, and adds, "I prophesy, that a conversion of bezoaric into gallic acid has here taken place." This is certainly the cheapest manner of obtaining the reputation of a prophet, and of securing to himself priorities of discoveries. In no country in the world would such proceedings be tolerated. J. L.

NOTE ON A SERIES OF THE PHOSPHATES OF ZINC AND COBALT.*

BY M. F. FLORES DOMENTE.

Every chemist who has been engaged in the analysis of the ores of cobalt, is aware of the difficulties encountered in separating cobalt from zinc. In fact, these metals are both precipitated by the alkaline sulphurets, carbonates, and oxalates. I hardly know any substance, with the exception of potash, that reacts in a different manner on both the metals, so that this process, based on the action of this chemical agent, is both tedious and inexact, since it is very difficult to avoid leaving a small quantity of zinc in the cobalt; the washing occupies much time, and we always have to dread the presence of some organic substance holding cobalt in solution.

Struck with these inconveniences, I asked myself whether we might not employ, when engaged on the quantitative analysis of these metals, a reagent that would precipitate them successively, leaving a well-decided point of time between the two precipitations. It was for the purpose of making this experiment I tried phosphate of soda, thinking that, if the cobalt was precipitated before the zinc, I could easily divide the operation by taking advantage of the difference between the salts of the two metals: one being coloured, while the other is colourless. My expectations were not realised—the two salts were precipitated in a confused manner; still, however, this experiment led me to observe a fact, which I hope has some interest. I discovered that if we poured a concentrated solution of phosphate of soda into a mixture of a salt of zinc and one of cobalt, we obtained, according to the temperature, or the proportions of the salts employed, a salt of a magnificent blue colour, or of an equally pure red, or otherwise; a series of other similar salts offering various intermediate tints. These salts are all insoluble in water, have the same crystalline appearance, and merely differ by their varying shades of colour. In other respects they are all shin-

* *Journal de Pharmacie.*

ing, silky, soft to the touch, and remind us, by their appearance, of glass in thin laminæ, or sublimated naphthaline. Their analysis proved to me—1. That they all contained zinc, cobalt, and phosphoric acid. 2. That these elements entered into the composition of the salts in various proportions, and that the zinc predominated in the red salts, and the cobalt in the blue salts. The quantitative analysis I made of two of these extreme compounds—that is, of the bluest and reddest salts—gave me the results I am about to describe. In the first place I must notice the plan that succeeded best in preparing these products. To obtain the blue salt, we boil a tolerably concentrated solution of nitrate of cobalt, and we add by degrees a weak or concentrated solution of phosphate of soda, until the liquid becomes colourless; all the cobalt is then precipitated in the state of phosphate of cobalt. We keep up the ebullition, and pour into the mixture nitrate of zinc, until the precipitate becomes crystalline, and of a deep blue colour; we then allow it to become cold, and decant the mother liquors: the precipitate is easily washed by decantation. The preparation of the red salt is the same as that of the blue, it only differs from its being necessary, to obtain this product, to add a larger proportion of nitrate of zinc.

COMPOSITION OF THE RED SALT.

	By experiment.		By theory.
Phosphoric acid ..	45·1	..	45·3
Oxide of cobalt ..	11·2	..	11·8
Oxide of zinc	27·2	..	25·8
Water	16·5	..	17·0

COMPOSITION OF THE BLUE SALT.

	By experiment.		By theory.
Phosphoric acid ..	45·2	..	45·5
Oxide of cobalt ..	16·9	..	15·8
Oxide of zinc	21·7	..	21·5
Water	16·2	..	17·0

These analytical results appear extremely different, but by calculation they can be reduced to a perfectly similar formula; in fact, both the salts contain 3 equivalents of the base for 2 equivalents of phosphoric acid, as we may see by the following formula:—

Red salt, $2\ Ph\ O^5 \left\{ \begin{matrix} Co\ O \\ 2Zn\ O. \end{matrix} \right.$

Blue salt, $6\ Ph\ O^5 \left\{ \begin{matrix} 4Co\ O \\ 5Zn\ O. \end{matrix} \right.$

We have, therefore, for the general formula of these two salts, $2\ Ph\ O^5\ 3\ M\ O$. These two salts are hydrates: the red contains 6 equivalents of water for 3 equivalents of the base; the blue 18 equivalents for 9 equivalents of the base: it is, as we see, 2 equivalents of water for each equivalent of the base. This water is partially disengaged at 462° F. At this temperature the red salt retains 2 equivalents of water, the blue salt 6 equivalents; that is to say, both of them contain 2 equivalents of water for 3 equivalents of the base.

When we heat these two salts, that is to say, the blue and the red, to 432°F., the red becomes blue, while the blue retains its colour; but if we heat them beyond this temperature, we perceive that the blue, in its turn, becomes red, and the red, from being blue, as it was at 432°F., assumes its original colour.

The constitution of these double phosphates reminds us, if I am not deceived, of certain alums which contain, at the same time, potash and ammonia in the most different proportions. It may also be compared with that of certain minerals, containing several oxides in various proportions; such, for example, is wolfram, which nature produces in a state of complete impurity, and which, as M. Ebelman has shown, is formed by the union of a tungstate of manganese, and a tungstate of protoxide of iron, in which we may also meet with lime, isomorphous magnesia, and oxide of iron, while at the same time it preserves the same appearance and the same formula.

I am in hopes that other metals will yield me series of similar compounds; it is a task on which I am now engaged under the direction of M. Pelouze, who has been kind enough to assist me with his advice in these, my first attempts.

ON THE ATOMIC WEIGHT OF CHLORINE.*

BY PROFESSOR MARIGNAC.

THE result obtained by M. Gerhardt † differs considerably from that at which I had arrived. He finds that 100 parts chlorate of potash leave, on calcination, 60·949 chloride, while I found 60·839, agreeing with Berzelius, who long previously had obtained 60·85, and with Pelouze, who found 60·840. It is my intention to show that this difference cannot be owing, as supposed by M. Gerhardt, to a small quantity of chloride of potassium having been carried away in my experiments by the oxygen gas; and I do not think it will be very difficult.

In fact, in all my experiments, besides

* *Bibliothèque Universelle*, and *Chem. Gaz.*

† See page 40 of the present volume of *The Chemist*.

the stopper of asbestos placed in the neck of the retort to arrest the powder of the chloride, the gas was passed through a U-shaped tube, filled with small fragments of pumice-stone moistened with sulphuric acid, to retain any traces of water arising from an imperfect desiccation of the chlorate of potash. Now, in my last experiments, the salt being perfectly dry, this tube did not increase in weight. It is impossible to admit, in presence of this fact, that any chloride of potassium was carried away; moreover, other experiments prove it still more evidently. I endeavoured to detect the presence of chlorine in the oxygen proceeding from the calcination of the chlorate of potash, either by passing the gas into several washing flasks containing nitrate of silver and sulphurous acid, or by receiving it in a balloon which had been exhausted, and where it remained for 24 hours in contact with ammonia. In both cases I detected the presence of chlorine, but I showed that the quantity was too insignificant to have any influence on the results of the analysis. But by these processes I ought likewise to have collected all the chloride of potassium, which might have been carried away by the oxygen; and as I operated on more than 50 grms. of substance, I ought, according to M. Gerhardt, to have found at least 55 milligrms. of chloride, whilst I did not find one. I do not pretend that that chemist has obtained inaccurate results, but I think it is impossible to suppose that the difference between our results can be owing to any loss of chloride of potassium in my experiments; those of M. Gerhardt not having been described in detail, I cannot pass judgment on them. I will only observe, that he experimented with 4 to 5 grms. substance, whilst I used 60 to 70, which appears to me considerably to diminish all chance of error.

Let us now suppose that the experiments of M. Gerhardt are accurate, and follow out the consequence. In the first place, we find for the equivalent of chloride of potassium the number of 936·45. As he has made no other experiment to determine the proportions of chlorine and potassium contained in that salt, we are compelled to calculate them either from the experiments of Berzelius or from mine. Now, according to Berzelius, 100 parts chloride of potassium are equivalent to 192·40 chloride of silver; I found 192·269. From this results, for the equivalent of chloride of silver, one of the two numbers 1801·73 or 1800·50. Now Berzelius found that 100 parts of silver yield 132·75 chloride of silver; I obtained 132·854. I therefore calculate for the equivalent of silver, adopting the numbers of Berzelius, 1357·24; and, according to my own, 1355·25. Chlorine therefore will be 444·49 or 445·25.

Thus, whether we take the analysis of Berzelius or mine, we, under no circumstances, arrive at the number 450 for the equivalent of chlorine. It is impossible to conceive how M. Gerhardt has obtained this number unless it is founded on analyses, which he has not mentioned in his memoir.

It will not perhaps be useless to offer some observations on the very intimate and carefully determined relations which connect the equivalent of chlorine with that of several other simple bodies. This connection is such, that before pretending to alter the equivalent of that body, and to raise it to 450, it would be requisite to repeat a large number of analyses, the accuracy of which appears to be well-established, but which on this supposition would become quite contradictory.

The equivalent of silver is deduced directly from that of chlorine by the analysis of the chloride of silver; now this analysis is easy; it has been made very frequently, and always with slightly varying results. It is impossible, according to these analyses, to retain 1350 as the equivalent of silver with 450 for chlorine*; the atomic weight of that metal must necessarily be raised, and all the experiments indicate in that case 1370 to 1375; to conform to the views of the partisans of the multiples of hydrogen, we are forced to admit 1375.

The equivalent of carbon is deduced from that of silver by very easy experiments, in which it is impossible to commit any great error. They are based on the decomposition of salts of silver with organic acids. We find very minute researches on this subject in a memoir by Liebig and Redtenbacher on the atomic weight of carbon; they arrived at the same results by the analysis of the acetate, tartrate, paratartrate and malate of silver. I shall confine myself here to the acetate of silver, from the ease with which this salt is obtained in a state of perfect purity. 28·8098 grms. acetate of silver yielded 18·6113 silver, or 64·6 per cent. I repeated these experiments two years ago, when engaged in my researches on the atomic weights of several bodies. Never having published the analyses, which I merely communicated at the time to M. Dumas, I will here detail the results.

Having prepared the acetate of silver from

* This would require that 100 parts silver should yield 133·33 chloride. Berzelius found 132·75, while I obtained 132·85.

pure carbonate of silver and acetic acid, and again purified it by two crystallisations, it was analysed by calcining it in a small porcelain capsule; and I obtained—

Acetate	3·3359 grms.	gave 2·1561 silver	= 64·633 per cent.
..	3·0527 ..	1·9727 ..	64·621
		Mean	= 64·627

This result, corrected for the weight of air displaced in the weighing, gives 64·609, a number extremely near to that obtained by Liebig and Redtenbacher.

Nevertheless, there seemed to me a slight source of error in the process I had followed; in fact, it is impossible to prevent, in this method, some particles of silver being carried away and lost during the decomposition of the salt. To avoid this, I modified the experiment by enclosing the silver salt in a tube of hard glass, through which a current of air was drawn by an aspirator, to complete the combustion of the charcoal after the calcination. On heating first the anterior part of the tube, and advancing the fire gradually to the other extremity, I forced the gases arising from the decomposition of the salt to pass through a long column of reduced but porous silver, so that not a particle of silver could be carried away. By this process I obtained—

Acetate once crystallised	24·717 grms.	gave 15·983 silver	=	64·665 per cent.
Acetate twice crystallised	21·202 ..	13·709 ..		64·661
Acetate thrice crystallised	31·734 ..	20·521 ..		64·666
Total.....	77·653	50·213	Mean =	64·664

This process is evidently more accurate than the other, and leads to a somewhat higher proportion of carbon. However, it will be seen that whatever experimental result we adopt, the conclusion will always be the same.

If the equivalent of silver is 1375, the equivalent of carbon will be, according to the experiments of Liebig and Redtenbacher, 79, and according to mine, 78·47, numbers which are equally contradicted by the beautiful experiments of Dumas on the atomic weight of carbon. If we start with the number 75 as the equivalent of carbon, which may be considered extremely accurate, we find for the equivalent of silver, according to my experiments, 1349·6. I had arrived at 1349·01 by the simultaneous examination of chlorine, potassium and silver. So perfect an agreement between results obtained by such different processes scarcely admits of our supposing any considerable error in these numbers.

The equivalent of nitrogen is likewise connected with those of silver and chlorine by experiments susceptible of very great precision, so that it would be impossible at present to modify one of those equivalents without first proving by experiments that the analyses hitherto considered as accurate are entirely erroneous. The equivalent of nitrogen is fixed with great precision by the density of the gas; it is 175, or differs very little from it. I adopt the whole number, feeling certain that none of the partisans of the theory of multiples of hydrogen will object to it.

Now if we adopt for one moment the multiples of hydrogen, 1375, 450 and 175 as the atomic weights of silver, chlorine and nitrogen, we arrive at the following results:—100 parts silver should yield 156·36 nitrate; I found by experiment 157·455, and L. Gmelin obtained 157·43 to 157·62. 100 parts silver in solution would be precipitated by 49·09 chloride of ammonium; I obtained 49·556, and M. Pelouze found 49·556 and and 49·517. All the results of these experiments are evidently too widely different from the calculated numbers; consequently either all these analyses are erroneous, or the equivalent 450 must be rejected.

I will here mention, in conclusion, some experiments I made with the view of connecting the equivalent of lead with that of chlorine. I never published the results, because they did not agree sufficiently with one another for accurate determinations of atomic weights; I believe however they may be of some interest in this discussion.

If chlorine gas is passed over melted lead raised to a high temperature, combination takes place with heat and light, and fused chloride of lead is obtained. This method of analyses is very accurate. Some very pure lead was placed in a tube of hard glass, through which a current of chlorine was passed. A stopper of asbestos, placed close to the end, prevented any chloride of lead, volatilized at the moment of combination, being carried away. I obtained in this way the following results:—

Lead 20·506 grms.,	chloride 27·517	= 134·190	per cent.
.. 16·281 ..	.. 21·858	134·255	..
.. 25·454 ..	.. 34·149	134·159	..
		Mean = 134·201	

Thus 100 parts of lead combine with 34·241 chlorine; if we calculate thence the equivalent of lead, adopting 443·20 for chlorine, we obtain 1295·87; adopting 450 for chlorine, we should obtain 1315·75.

I likewise attempted to convert a known weight of chloride of lead into chloride of silver by precipitating it with nitrate of silver, and I obtained the following numbers—

Chloride of lead 12·534 grms.,	chloride of silver 12·911	= 103·01	per cent.
.. 14·052 ..	.. 14·506	103·23	..
.. 25·533 ..	.. 26·399	103·39	..
		Mean = 103·21	

This number differs very little from that found by Berzelius, 103·35. Starting from these results, and adopting the old equivalents of chlorine and silver, we find for lead 1293·27; while if we adopt 450 for chlorine and 1375 for silver, we shall have for lead 1318·24. The equivalent of lead has been determined with very great precision by Berzelius, by the reduction of the oxide of lead by hydrogen, and the number obtained is 1294·5. As will be seen, it agrees very well with my experiments; but it is necessary to discard entirely the equivalent 450 for chlorine.

I do not bring forward the preceding analyses as serving to determine an atomic weight with precision; they differ too much one from another to allow of a mean being taken, but they nevertheless suffice to establish an absolute incompatibility between the equivalent of lead and the equivalent 450 for chlorine; each one, in fact, taken separately, leads to the same result.

The above considerations will probably appear rather long for the purpose of refuting an hypothesis which is not yet supported by a complete series of experiments. I wished however to develop them, in order to show that, even when a system of experiments apparently irreproachable should lead any chemist again to adopt the equivalent 450 for chlorine, the question would still not be solved; and that, to give weight to such an opinion, he ought to repeat all the experiments above-mentioned, and to show what errors could have led to results so different from those which ought to have been obtained according to this hypothesis.

ON THE SOLUBILITY OF GYPSUM IN WATER AND IN A SOLUTION OF CHLORIDE OF SODIUM.*

BY M. ANTHON.

The author digested pure artificially-prepared gypsum, at the ordinary temperature, in one closed vessel with distilled water, and in another with a saturated solution of culinary salt. On examination, he obtained from 1000 grms. of the first liquid with chloride of barium 3·1 grms., from the second 11·1 grms. sulphate of baryta. In accordance with this, gypsum dissolves in 438 parts pure water, and in 122 parts solution of chloride of sodium.

ON CHLOROCYANIMIDE.†

BY M. AUG. LAURENT.

Ammonia forms two principal classes of combinations—one class being usually called salts of ammonium, and the other salts of ammonia. The first includes all the salts formed by the union of hydro-acids and hydrated oxacids with ammonia, and the second contains the singular combinations formed by this alkali with the anhydrides: that is to say, with the anhydrous acids, chlorides, and fluorides.

We generally admit that the compound bodies which have entered into the composition of the latter, remain, after combination, in their primitive state; that is to say, that the sulphate of ammonia, or the sulphammon for example, contains sulphuric acid and ammonia.

I have already shown that when an anhydrous oxacid is combined with ammoniacal gas, it, in the first instance, produces a

* Buch. *Rep.*, xli., p. 363.
† *Comptes Rendus.*

peculiar acid, which, by absorbing a fresh quantity of gas, forms a saline combination, analogous to the salts we call salts of ammonium. Thus the anhydrous sulphate and oxalate are not, in my mind, merely the sulphamate and oxamate of ammonium; besides, it is of little moment whether we admit of the existence of ammonium or not.

Experiment having, up to the present day, confirmed my theory of the amidated acids, there remains to be examined the combinations formed by ammonia with the fluorides and chlorides.

M. Gerhardt and I resolved to make experiments on this subject; but M. Gerhardt being particularly engaged on the combinations of ammonia, I thought we should the more readily discover the constitution of these compounds by means of analogy, and I endeavoured to discover whether aniline, which, up to the present day, has exhibited so great a resemblance to ammonia, would not also form combinations with the chlorides and fluorides.

I first directed my attention to the solid chloride of cyanogen, and along with M. Delbos, to the fluoride of silica. At a future period I propose to extend my researches to other chlorides.

When we treat the solid chloride of cyanogen with aniline, in the presence of water, a combination is immediately formed, which I shall call chlorocyanilide, the composition of which is completely analogous to that yielded by ammonia with the same chloride.

The following equation shows its formation:—

Chlorocyanimide.

$$C^3\,N^3\,Cl^3 + C^{24}\,H^{28}\,N^4 = (C^3\,N^3\,Cl + C^{12}\,N^2\,H^{13}) + 2\,(HCl + C^6\,H^7\,N.)$$

That is to say, 1 equivalent of solid chloride, by reacting on 4 equivalents of aniline, yields 1 equivalent of chlorocyanilide and 2 equivalents of chlorohydrate of aniline.

M. Gerhardt and I have shown that when we heat chlorocyanimide, the whole of the chlorine is separated from it in the state of hydrochloric acid and hydrochlorate of ammonia, while mellon remains, and when we treat this amide with potash, ammelide is formed.

Chlorocyanilide, submitted to the same agents, exhibits reactions which, without resembling the preceding, have, nevertheless, much analogy with them. Thus under the influence of heat it loses all its chlorine in the state of hydrochloric acid, while a new substance remains, whose composition should be represented by $C^{12}\,N^5\,H^{11}$. We perceive that if the chlorine, by disengaging chlorocyanilide, carried aniline along with it, a combination must have remained analogous to mellon.

Submitted to the action of potash, chlorocyanilide loses hydrochloric acid, absorbs 1 equivalent of water, and by deducting 1 equivalent of aniline, we should have a body corresponding with ammelide, whose formula is $C^{15}\,H^{13}\,N^5\,O$. If we deduct 1 equivalent of water, we should have the preceding combination; and if we again add 1 equivalent of water, by deducting 1 equivalent of aniline, we should have a body corresponding with ammelide.

Notwithstanding the interest attached to this subject, I have not been able, for want of matter, to study it properly; but M. Persoz having been kind enough to promise me some solid chloride of cyanogen, I hope I shall be able to resume my inquiries into these combinations.

ON SISMONDINE, TALC, AND STEATITE, AND ON THE HYDRO-SILICATES OF COPPER.*

BY M. A. DELESSE.

SISMONDINE.

HAVING had an opportunity of obtaining extremely pure fragments of this new mineral, which is met with at St. Marcel, in Piedmont, and of which I gave a description twelve months since, I made a new analysis and obtained—

Silex	24·10—2
Protoxide of iron	27·10—1
Alumina (difference)	41·56—3
Water	7·24—1

The amount of oxygen is in the same proportions as the simple numbers 1, 2, 3; sismondine, may therefore be represented by the formula—

$$Si^2\,Fe + Al^3\,H\,O = Si\,Fe^3 + 3\,Al\,H.$$

Consequently we may consider it as formed of one atom of wollastonite, with an iron base, combined with three atoms of diasphone.

TALC AND STEATITE.

These two minerals are common in nature; mineralogists, however, do not agree as to their constituents. I have

Comptes Rendus, April 6.

examined a specimen of talc from Rhode Island, in the United States, which, according to the measurements made by M. Descloiseaux and myself, appeared to belong to a rhomboidal prism, of 113° 30′: chemical analysis gave me

Silex	61·75	—7½
Water	4·83	—1
Magnesia	31·68	—3
Protoxide of iron	1·70	

At present, every analysis of talc, that we have made, referring particularly to the water it contained, has proved that the amount is almost uniform. Of this M. Marignac, also, is satisfied, who, at my request, repeated the analysis of the talc of St. Gothard; the water is in such a state of combination that it is impossible to remove it completely by the heat of the spirit-lamp; this property of talc also belongs to steatite: it is, therefore, characteristic of the hydrosilicates of magnesia, which are found in the same description of deposits. By admitting that the proportions of oxygen are as 1, 3, 8, we should have the very simple formula—

$$Si^3\ (Mg\ H^3).$$

already proposed by M. Berthier; nevertheless all the analyses of talc, corrected by the preceding, having regard to the quantity of water, vary in the same direction, and the oxygen of the silica is always less than double the oxygen of the bases. This constant difference is perhaps rather incorrect in the determination of the atomic weights of the magnesia, or even of the silica; but, at present, it will, I think, be convenient to adopt, provisionally, for the talc, the following more correct formula:—

$$Si^5\ Mg^6 + H^3 = 3\ Si\ Mg + Si^2\ Mg^3 + 2\ H^2.$$

In the greater number of mineralogical collections, also, the name of talc is applied to rocks that differ much in appearance: they are usually masses of steatite, chlorite and ripidolithe, which only contain a few lamellæ of talc.

The steatite examined was milk-white. It was brought from Nintsch, in Hungary. It is the *specstein* of the German mineralogists. It appears to be tolerably homogeneous; this is not the case with the greater number of the minerals considered as steatites, which are merely species of gneiss, having lamellæ of talc scattered through the substance of a paste of steatite.

We see that it ought not to considered as compact talc; for, while in the case of the talc the density is diminished one-third, by calcination, it is augmented for the steatite; the chemical composition, also, is different, for we find—

Silex	64·85	—15
Magnesia	28·53	—5
Protoxide of iron	1·40	
Water	5·22	— 2

The determination of the water in several steatites gave nearly the same results, and the preceding analysis led to the formula

$$5\ Si\ Mg + H^2.$$

The steatite of Nintsch is formed, therefore, of neutral magnesia, combined with water, in the atomic proportions of 5 to 2.

The presence of a considerable quantity of water as a constituent in talc and steatite, is a fact which appears to be of importance, in a geological point of view, and it ought necessarily to be taken into calculation in all our hypotheses for the explanation of their origin.

HYDROSILICATES OF COPPER.

This memoir has for its object—the study of the products of the decomposition of antimonial and sulphuretted minerals of copper, produced by the different mines now at work, a great number of which have been sent me by M. Bural. The comparative examination I have made of various modern products with the hydrosilicates of copper, which we found in veins or in stratified districts, led me to conclude that the hydrosilicates of copper, which are met with in nature, are the products of decomposition during different geological periods, and which have originated in the same manner as the minerals called *parasites* by M. Haidinger.

ON FLUOSILICANILIDE.*

BY MM. AUG. LAURANT AND I. DELBOS.

ANILINE, in the presence of fluoride of silicium, rapidly absorbs that gas, forming a solid and apparently homogeneous substance, the composition of which may be represented by 5 equivalents of aniline and 3 equivalents of fluoride of silicium ($F^4\ Si^3$).

But the result of this combination is a mixture of hydrofluorate of aniline and a fluosilicic anilide, whose composition should be represented by $C^{24}\ H^{27}\ F^{11}\ Si^6\ N^4$.

When we treat this mixture with alcohol at 0·86, the hydrofluorate is dissolved, while the anilide absorbs 3 equivalents of water to form a new combination, which we shall call *fluosilicanilide*, and whose composition is represented by $C^{24}\ H^{33}\ F^{11}\ Si^6\ O^3\ N^4$.

This anilide readily crystallises in alcohol, and, notwithstanding the presence of silicium and oxygen, it is completely volatilised without decomposition.

* *Comptes Rendus.*

Submitted to the influence of bases, it regenerates hydrofluoric acid, silicic acid, and aniline.

Chlorocyanilide and fluosilicanilide show us that when aniline is combined with the chlorides and fluorides, it forms, not a simple combination, but a mixture of several bodies. It is, therefore, very probable that the combinations of ammonia with the anhydrids are not simple combinations of ammonia, but mixtures of amides and salts of ammonia, or amidated salts of ammonium.

ON THE ACTION OF NITRIC ACID ON BRUCINE.*

BY M. AUG. LAURENT.

We all know that brucine becomes of a very deep red colour when nitric acid is poured upon it. It is now some time since M. Gerhardt, while attentively examining this phenomenon, perceived that a gaseous body was disengaged; at the ordinary temperature it was slightly soluble in water, had the decided smell of the rennet apple, producing, when burnt, a yellowish flame, accompanied by nitrous vapours. For want of matter, M. Gerhardt did not proceed further with his experiments; but he, nevertheless, thought he might conclude that the gas disengaged from the brucine was nitrous ether.

M. Liebig repeated this experiment, and thus it is he expresses himself in the diatribe he launched against us. "The production of nitrous ether by a body that contains neither alcohol nor ether, appeared to me to be as remarkable as it was important in the history of etherated combinations, on which account I resolved to repeat M. Gerhardt's experiments; I condensed a portion of the gas disengaged by the brucine, and I obtained a liquid that did not mix with water, heavier than diluted nitric acid, and boiling at from 158° to 162° F."

As nitrous ether is lighter than water, and boils at 61° F., M. Liebig concludes that M. Gerhardt is a *shameless liar.*

Not understanding how a gaseous body, at the ordinary temperature, could form a liquid that did not boil under 158° to 167°, I, also, resolved to repeat M. Gerhardt's experiment.

I operated on 15 grammes of brucine, and after having passed the gas over lime, I condensed it by means of a mixture of ice and common salt. I obtained about 1 gramme of an extremely fluid liquid lighter than water, and possessing the odour of nitrous ether. I distilled this liquid, almost to the last drop, without allowing it to boil, at a temperature not exceeding 50° F., and I then subjected it to analysis.

The following are the results of my experiments:—

	By Calculation.	By Experiment.
C^8	32·0	29
H^{10}	6·6	6
N^2	0	0
O^4	0	0

The hydrogen and the carbon are exactly in the same relative proportions as in nitrous ether. As to the loss, that may be easily understood, considering the small quantity of liquid I had at my disposal, and the difficulties by which the analysis was surrounded.

These results, I think, allow me to conclude with certainty, that the gas which is disengaged at the ordinary temperature, when we pour nitric acid upon brucine, is, as M. Gerhardt has asserted, nitrous ether.

This production of nitrous ether has appeared so remarkable, or so little probable to some chemists, that they have requested me to repeat my experiment on a large scale. But the price of the brucine being too high to allow me to make fresh experiments on the nitrous ether it produces, I undertook the examination of the second body which arises from the reaction of nitric acid on brucine. When the acid has ceased to act upon this alkali, at the ordinary temperature, the latter is changed into an orange-red substance, which I have succeeded in crystallising. This new substance, which I shall call *cacotheline* when subjected to analysis, yielded results which are very correctly represented by the following formula:—

$$C^{21}\,H^{22}\,N^4\,O^{10}.$$

If, from 1 equivalent of brucine, and 3 equivalents of nitric acid, we deduct 1 equivalent of nitrous ether, and 1 equivalent of water, the remaining elements would represent cacotheline.

Brucine.

$$C^{32}\,H^{26}\,N^2\,O^4 + 3\,N\,H\,O^3 =$$

Nitrous ether.

$$C^{21}\,H^{22}\,N^4\,O^{10} + C^2\,H^5\,O^2\,N + HO.$$

It is true that this equation gives no account of the formation of the heavy and little volatile liquid, obtained by M. Liebig; but it must be observed, the object this eminent chemist had in view when making the experiment, was to prove that M. Gerhardt had committed an error, and that, the better to attain his end, he did not place himself under the same circumstances as M. Gerhardt.

Cacotheline, when subjected to the action of ammonia, is transformed into various

* *Comptes Rendus.*

products, among which we find an alkaline base, remarkable for several of its properties. It contains the elements of nitrous vapour, and comports itself under the influence of heat, in the same manner as substances that have been changed by the action of hyponitric acid. It dissolves in concentrated sulphuric acid, becoming of a magnificent red colour, which changes to lilac blue by the action of heat. It forms, with bichloride of platinum, an orange-red salt. The small quantity of the substance I had at my disposal, did not give me the opportunity of making an analysis.

COMPARATIVE PROPORTIONS OF NUTRIMENT IN ORGANIC ALIMENTS.*

Messrs. Schlossberger and Kemp, adopting the views of Liebig as to the distinction between the elements of food used for reproduction or growth, and those for respiration, have prepared a table, which exhibits the nutritive power of different alimentary substances, the test of this power being the quantity of nitrogen which those substances respectively contain. The proportion of this element contained in human milk dried at 212° F., being taken at 100, the degree of nutritive power of other alimentary substances may be expressed by the numbers placed next to them. We select a few of the principal.

"*Vegetable.*—Rice, 81; potatoes, 84; rye, 106; wheat, 119 to 144; maize, 100 to 125; oats, 138; white bread, 142; carrots, 150; brown bread, 166; peas, 239; haricot beans, 283; beans, 320.

"*Animal.*—Human milk, 100; cow's milk, 237; oyster, 305; yolk of egg, 305; cheese, 331 to 447; eel, boiled, 428; porkham, boiled, 807; salmon, boiled, 610; portable soup, 764; white of egg, 845; skate, boiled, 956; herring, boiled, 808; haddock, boiled, 816; pigeon, boiled, 827; mutton, boiled, 852; veal, boiled, 911; beef, boiled, 942.

"*Purified muscular fibre from various animals.*—Fibre of eel, 908; of salmon, 982; of herring, 914; of haddock, 988; of pigeon, 775; of lamb, 916; of sheep, 928; of calf, 993; of ox, 935; of sow, 893.

"*Proximate principles of animals, calculated from the quantity of nitrogen, as determined by Mulder.*—Pure protsine, 1006; pure albumen, 996; pure fibrine, 999; pure caseine, 1003; pure gelatine, 1128; pure chondrine, 910."

* *Edin. Med. and Surg. Journal.*

It should be observed, that this is a purely chemical way of considering the question. The facility with which these different substances submit themselves to the digestive process, dependent on various circumstances, must greatly modify the nutritive power.

REPORT ON TWO SAMPLES OF SALT WATER AND BITUMEN SENT FROM CHINA BY M. BERTRAND.*

BY M. BOUSSINGAULT.

M. Bertrand, a missionary in China, forwarded to M. Voisin, director of the Seminary for Foreign Missions, specimens of water and of bitumen, which he has presented to the Academy.

The Academy having charged us with the duty of examining these substances, we have laid before them the result of our inquiries. The salt water is of a reddish colour, and cloudy, from holding clay in solution, which is not entirely deposited when left at rest. A small quantity of mucilaginous matter, arising, probably, from the bamboo stem in which the water had remained, prevented the precipitation of the earth.

The salt water contained no trace of a sulphate; and when filtered it produced by analysis—

Chloride of sodium	16·0	21·2
Chloride of calcium	3·9	
Chloride of magnesium ..	1·3	
Hydrochlorate of ammonia ..	a trace	
Organic matter	a trace	
Water	78·0	

In the mother liquors that remained after the extraction of the sea salt, we found neither iodine nor potash. By the addition of caustic alkali, there arose a very perceptible smell of ammonia.

The bitumen, seen by a reflected light, was of a dingy green colour; by transmitted light it is brown. Its consistence, at the temperature of 59° F., may be compared to that of oil. It dissolves without a residuum in sulphuric ether: alcohol does not perceptibly dissolve it. If dissolved by the aid of a wax bath, which causes the temperature gradually to rise, it gives out, at 212° F., a scented colourless oil, possessing the principal characteristics of naphtha; this substance only exists in small quantities in the bitumen of China. It was necessary to raise the wax bath to from 302° to 392° F., to keep up a continuous distillation. We in this manner collected, without ebullition, a pale yellow carburet of hydrogen, possessing all the properties of petrolene; the liquid principle of the

* *Comptes Rendus*, April 2, 1846.

soft and viscous bitumens. By raising the heat of the bath, and maintaining it at nearly 490°, there remained in the retort a shining black substance, which became solid when cold, and might be compared to asphaltum. By operating upon several grammes of this substance, we were able to estimate the different products we have just mentioned, with sufficient accuracy to assign to the bitumen we examined the following composition:—

Extremely volatile oil analogous to naphtha	1·0
Petrolene	86·5
Solid bitumen, analogous to asphaltum	12·5
	100·0

The solution of the two products, of which we have just presented an analysis, is thus described by M. Imbert, a missionary in China:—The salt water was taken from the salt-wells, the bitumen from the fire-wells, *Ho tsing*. In the province of Sze Tchhuan, celebrated for the number and importance of its salt springs, they reckon, on a surface of about fifty square leagues, several dozen thousand salt wells. These wells, are, however, merely holes bored in the earth to obtain the salt; they are usually 500 or 600 metres in depth, with a diameter of 2 decimetres. The boring apparatus is worked by means of a rope and wheel. To draw off the salt water, they make use of a bamboo, about 8 metres in length, with a valve at the lower end. They obtain from this water from one-fifth to one-fourth of an extremely bitter salt. This agrees with the results of analysis, because we have shown, that in the water sent by M. Bertrand, there existed 0·21 of the salts of chloride of calcium, sodium and magnesium.

An extremely inflammable gas arises from these salt wells, so that it is dangerous to bring a light near their openings. They even bore wells for the purpose of obtaining this gas. These fountains of fire are extremely common at Tseu-lieou-tsing, at a place about 16 myriametres from the residence of M. Imbert. The water in one of these wells being exhausted, they continue to bore to the depth of 1000 metres: they do not again meet with water; but, when they have attained this enormous depth, there suddenly issues a jet of gas, which is used at the present day as a combustible, by means of a series of bamboo conduits terminated by tubes of baked clay, which carry it beneath the evaporating pans; the excess of gas being employed in lighting up the salt works.

According to M. Imbert, the gas of the fire-wells has a very decided smell of bitumen, a characteristic that renders it extremely probable that bitumen is to be met with in the saliferous lands of China. This probability has become a certainty by the specimens sent by M. Bertrand.

The chemical analysis of the salt water, and the bitumen, furnished by the bored wells of China, complete the particulars for which we are indebted to M. Imbert; and in procuring us the means of examining these products, M. Bertrand has rendered a real service to science.

ON THE PRESENCE OF SULPHOCYANOGEN IN HUMAN SALIVA.*

BY MAX. PETTENKOFER.

As authors are not agreed upon the occurrence of sulphocyanogen in the saliva, Gmelin, Ure, Liebig and Wright, speaking in favour of it, whilst Berzelius, Kühn and Müller are opposed to it, it appeared requisite to the author again to investigate the subject. The saliva used was collected from the author himself, and its secretion was promoted by smoking tobacco. It was acidified with sulphuric acid, and subjected to distillation to separate the volatile acids. After 24 grammes of the fluid had been distilled to about two-thirds, the author observed that when carbonate of lead was put into the receiver, it was blackened by sulphuretted hydrogen. This was supposed to arise from the presence of a metallic sulphuret in the saliva; but none could be detected; moreover, it was shown by another experiment, that sulphocyanide of potassium gave off sulphuretted hydrogen when distilled with sulphuric acid. The carbonate of lead used in the above distillation was boiled with water, and the filtrate evaporated to dryness. The residue was now boiled with alcohol, and the alcoholic extract also evaporated to dryness. On adding sulphuric acid to it, the odour of acetic acid was distinctly evolved. The portion of the aqueous extract insoluble in alcohol was composed of chloride of lead; hence muriatic and acetic acids had passed over. To separate the constituents of the portion insoluble in water, it was treated with a weak solution of carbonate of soda, the filtrate evaporated and exhausted with spirit. The spirituous solution was reddened by chloride of iron. The reddening certainly was less intense than that of the ordinary spirituous extract of saliva; still even this experiment goes far towards proving the presence of

* *Chemical Gazette.*

sulphocyanogen. The author next determined to examine carefully the means for detecting sulphocyanic acid. It is well known that acetic, formic and meconic acids produce the same reactions with chloride of iron as sulphocyanic acid. It is also known that a solution of peracetate of iron becomes turbid when boiled, but becomes nearly clear again on cooling. The latter phenomenon also occurs when sulphate of potash, nitre, chloride of sodium, &c., are heated with a solution of acetate of iron, and, as the author has observed, by continued ebullition with a sufficient quantity of chloride of sodium or potassium, the whole of the iron is precipitated; so that on cooling it requires a very considerable quantity of acetic acid to redissolve it. If the reddish-brown precipitate be collected on a filter, at first a transparent fluid passes through, containing no trace of iron; but after continued edulcoration, the precipitate on the filter begins to dissolve. Peroxide of iron and chlorine are detected in the solution; and if a little nitric acid be added to it, the greater part of the iron subsides in bright brown flakes. It has a powerful astringent, but not the least inky taste; and if metallic chlorides be added to it, the peroxide of iron it contains is again precipitated. The above dark brown solution is undoubtedly the basic chloride of iron mentioned by Phillips.

To examine this compound more minutely, the author burnt piano-forte wire in a current of chlorine, and digested the aqueous solution of the chloride thus obtained with hydrated peroxide of iron until the acid reaction and inky taste had disappeared. On estimating the chlorine by silver and precipitating the iron by ammonia, the author obtained the formula $2Fe^3Cl + 2Fe^2O^3$. The solution became turbid on evaporation, and hydrated peroxide of iron separated.

Thus, the property of fluids which are of a red colour from the presence of acetate of iron, of being perfectly decolourized on ebullition with alkaline metallic chlorides, enables us to distinguish them readily from the precipitation produced by sulphocyanic acid. Formic acid reacts upon peroxide of iron exactly as acetic acid, except that the precipitation of the iron on boiling occurs much sooner, especially when chlorides are added. The red colour caused by meconate of iron cannot be removed by this means. To distinguish the sulphocyanate of iron from the meconate and the acetate, the author recommends the red ferrocyanide of potassium. Thus, if the red ferrocyanide of potassium be added to the red solution of chloride of iron and sulphocyanide of potassium, Prussian blue falls in a short time, and immediately if heat be applied. The odour of prussic acid also becomes evident. An explanation of this process cannot at present be given with certainty; it may however be remarked, that no products of the decomposition of sulphocyanogen can be detected, but that the greenish fluid again yields Prussian blue on the addition of chloride of iron and red ferrocyanide of potassium. The latter salt does not exert the least action upon the meconate, acetate, &c. of iron.

To apply these results to test the saliva, the author evaporated fresh saliva almost to dryness, exhausted it with strong spirit, again evaporated, and dissolved the alcoholic residue in water. The solution was very strongly reddened by neutral chloride of iron, and let fall some brown flakes; but it could not be caused to disappear by the addition of chloride of sodium nor of ammonium. A very minute portion only of the colour could therefore have been caused by acetates. Another portion of the salivary extract was reddened by a few drops of chloride of iron, and treated with red ferrocyanide of potassium, whereupon the formation of Prussian blue described above occurred. Another portion of the extract was boiled with chlorate of potash, muriatic acid being at the same time added in drops. chloride of barium then gave a precipitate of sulphate of baryta, which was not the case previously. When the extract was treated with a solution of lead in caustic potash, no formation of sulphuret of lead could be detected; but when it was boiled with sulphuric acid, and a moist piece of lead-paper held over it, it was distinctly rendered brown. By numerous repetitions of the above experiments on the saliva of different persons, the author obtained the same results; so that the occurrence of a metallic sulphocyanide in saliva may be admitted with certainty.

To estimate the sulphocyanogen in saliva, Wright advises us to form sulphocyanide of lead, to weigh this, and to calculate the quantity of sulphocyanide of potassium in the saliva from it. But the metallic chlorides, &c., in the saliva inevitably produce error, consequently, according to Wright's experiments, the amount of sulphocyanogen in the saliva is much too great. Hence the author recommends the oxidation of the sulphocyanogen, so as to form sulphuric acid, and the estimation of the latter by baryta. A weighed quantity of saliva is evaporated, exhausted with alcohol, the latter evaporated, the residue dissolved in water and boiled, chlorate of potash and a little muriatic acid being added. Before adding the muriatic acid,

the fluid must be heated to boiling, otherwise a little sulphocyanic acid will escape undecomposed. The author thinks that the small quantity obtained by Kühn may be explained in this manner. 100 parts of sulphate of baryta correspond to 25·11 sulphocyanogen, or 41·21 sulphocyanide of potassium. In this analysis care must be taken that no other sulphur-compound exists in the solution. The alcoholic solution of the solid residue of saliva leaves almost all the sulphates which may be present undissolved. If not, their separation must be previously effected by a soluble salt of baryta; sulphurous acid and hyposulphuric acids must be previously converted into sulphuric acid by peroxide of lead. Metallic sulphurets might be removed by digestion with carbonate of lead. The author ascertained, by counter experiments, that the sulphur of the sulphocyanogen is completely oxidised in the above manner.

The mode of formation of the sulphocyanogen in saliva has hitherto proved a stumbling block; but if we regard urea as a cyanate of ammonia, $C^2 NO + NH^4 O$, and compare the formula of sulphocyanide of ammonium with it, $C^2 N S^2 + N H^3$, we find a striking relation between them; for if we replace 2 equiv. of oxygen in the urea by 2 equiv. of sulphur, we have the elements of sulphocyanide of ammonium, $C^2 N^2 H^4 S^2 = C^2 N S^2 + N H^4$. Moreover, the products of decomposition of the two substances on destructive distillation are to a certain extent similar. The author has also found that urea may be converted into a compound of sulphocyanogen by the action of alkaline sulphurets. Since urea occurs already formed in the blood, it would not appear improbable that by combining in the salivary glands with the sulphur of the protein compounds, it forms sulphocyanogen. Wright has remarked the excretion of urea in the saliva during salivation. It would be interesting to observe whether the saliva contains urea in mercurial ptyalism where the chloride of iron frequently does not cause any reddening.

AN ATTEMPT TO REFUTE THE REASONING OF LIEBIG IN FAVOR OF THE SALT RADICAL THEORY.

BY ROBERT HARE, M.D.,

(Prof. of Chemistry in the University of Pennsylvania.)

In our number for April we laid before our readers the first section of this paper of Dr. Hare's; the following, being the remaining portion of the paper, has been kindly forwarded to us. The author, addressing the editors of *Silliman's Journal* in the May number, in which the following will appear, observes—

Agreeably to the notice given at the close of my last communication in this journal, p. 89,* I will proceed with my objections to Liebig's reasoning in support of the salt radical theory, commencing with another quotation from his lectures delivered at Giessen, for that purpose.†

16. "In one atom," says the lecturer, "of a metallic oxide containing one equivalent of oxygen, this oxygen is replaced by one equivalent of chlorine, when brought into contact with an hydrogen acid. Take a metallic oxide containing two equivalents of oxygen, bring it into contact with an hydrogen acid, such as hydrochloric acid, what will be the chlorine compound produced? A corresponding metallic chloride. Take an oxide of the third class, (two atoms of metal, three atoms of oxygen,) what will be the product? A compound in which you will find two atoms of metal combined with three atoms of chlorine.

M O M Cl,
M O^2 M Cl^2,
M^2 O^3 M^2 Cl^3."

17. The facts mentioned in the preceding quotation being represented by Liebig as justifying an inference that the proportions in which chlorine and metals combine, is due to the oxygen and hydrogen with which they may happen to be in combination, he proceeds thus to proclaim his impressions. "Upon what, then, does the saturating capacity of the acid depend? Upon the hydrogen it contains. Upon what does the property of the base (of the metallic oxide) of neutralising the acid depend? Upon the oxygen it contains." Thus the property of the halogen bodies, of forming neutral haloid compounds with metals, is not the consequence of the affinity for metals which they exert when naked, but rests upon the fact that they *may have been, are now, or may hereafter be, severally in union with oxygen and hydrogen*; so that a mere liability to combine with these elements, endows them with a power to combine with other elements, of which power they otherwise would have been destitute. Liebig ascribes to hydrogen, not only the "action of presence," but an "action of absence" likewise. According to him, the halogen bodies owe their power of entering into union with metals to the hydrogen which they contain, not only *when the element is*

* *The Lancet*, vol. ii., No. 1090.

present, but to their susceptibility of uniting with it, whether *retrospectively* or *prospectively*. Let us see whether the phenomena on which these startling conclusions rest, are not susceptible of a more rational explanation.

18. When any radical unites in several equivalent proportions with any one electro-negative body, it will usually unite in the same proportions with other electro-negative bodies. This is in a great measure exemplified in the case of the oxides, sulphides, and chlorides of iron; the oxides, sulphides, and chlorides of tin and antimony. In like manner, the proportions in which oxygen enters into union with phosphorus and with arsenic are the same; also for every oxide of mercury we have a corresponding sulphide and chloride. But in some instances we have oxides of which there are no corresponding chlorides with the same radical. Thus in the instances of the metals potassium, sodium, calcium, barium, and strontium, we may have peroxides but not perchlorides. Whenever the metal can form a perchloride, its peroxide, on due contact with the chloride of hydrogen (muriatic acid), is resolved into water and a perchloride. But when the metal is incapable of forming a perchloride like those above-mentioned, peroxides are not convertible into perchlorides.

19. According to my apprehension, during the reaction of oxides with hydracids, so called, the hydrogen and oxygen only assist, by getting each other out of the way. In most instances, in which a chloride is generated by the meeting of an oxide with the chloride of hydrogen, it may be produced by presenting the metal to gaseous chlorine, *with* heat, if not *without*.

20. With respect to the peroxides of the metals of the alkalies and alkaline earths, it has been stated that the law here enunciated by Liebig (16) does not prevail; and I think it must be evident that the quantity of chlorine in the resulting chloride is dependent solely on the affinity between chlorine and the metal. The hydrogen may resist this affinity when oxygen does not co-operate, as when the metal is not oxidized; but even when present, hydrogen cannot be the cause or regulator of the affinity; and to suppose that when absent it imparts affinity or capacity, strikes me as unreasonable. Was there ever a greater heresy in science than this idea, that thirty-six parts by weight of chlorine combine with forty of potassium, not because it is the nature of these elements to unite in these proportions, but because one of them *has been*, is now, or *may hereafter be* united by a much less potent affinity to one part of hydrogen. With all due deference for the author, the efficiency attributed to hydrogen by him appears to me as unjustifiable as it is anomalous.

21. But it is with the chloride of hydrogen only that the binoxide of mercury will yield a bichloride? May not this last-mentioned compound, the well known corrosive sublimate, be obtained by sublimation of the sulphate or nitrate of the binoxide of mercury with various chlorides?

22. It is assumed by Liebig, in his lecture above-mentioned, to be a general law, that the number of equivalents of acid requisite to saturate a base, is equal to the number of atoms of oxygen which it may contain. His words are: "one equivalent of oxygen in a base requires one equivalent of acid, two require two, three require three." In the next paragraph the fact is cited, that protoxide of potassium will take only one equivalent of acid to saturate it. But if the preceding allegation be true, how does it happen that the peroxide of potassium does not take even one equivalent of acid, unless by being resolved into a protoxide, so that the addition of oxygen, instead of producing the result which flows from this general law, actually has an effect diametrically opposite? The same allegation may be truly made of the peroxides of each of the metals of the alkalies or of the alkaline earths. Yet the protoxide of potassium and sodium *both unite with two equivalents of sulphuric acid*.

23. In the instances of lead, tin, antimony, and manganese, the addition of oxygen beyond a certain amount destroys the affinity for acids attendant on inferior degrees of oxidation, no less than in the instances above-mentioned.

24. Among the evidences adduced by Liebig, as justifying the law above mentioned, is the fact, that in the persulphates of iron and chromium, two atoms of metal, taking three of oxygen to form a sesquioxide, one atom of the sesquioxide requires for saturation three atoms of acid; but the reason why neither iron nor chromium can form a binoxide, is a mystery which is not represented as explicable agreeably to the new doctrine. As there can be no doubt that there is a common rationale of this fact, and of the analogous necessity of three atoms of acid to saturate two of the resulting sesquioxide, it follows that there is only one mystery to explain agreeably to the old view of the constitution of oxysalts; but this mystery exists just as much in relation to the new view, substituting oxysulphion, or some other imaginary compound radical for

oxygen. The mystery in one case, is wherefore two atoms of mercury are capable of taking four atoms of oxygen with four of acid, when two atoms of iron can only take three of oxygen with three of acid. In the other case, the mystery is that two atoms of mercury should take four atoms of oxysulphion, while the same number of atoms of iron take no more than three.

25. In the cases above cited, hydracids in combining are made to abandon hydrogen; yet the oil of the Dutch chemists is represented by Liebig,* as a "hydrochlorate of the chloride of acetyl," in which muriatic acid is made to act as an acid, *in propriâ personâ*, without either losing or gaining hydrogen. In this instance, it would seem that the celebrated author had precisely the same view of an acid which has been heretofore generally entertained, *that it is a body that will combine with a base without decomposition.*

26. Agreeably to the language held by this great chemist respecting his hydracids, it would seem as if the essential character of acidity were an incapability of existence, excepting by being first united with hydrogen, and a susceptibility of being resolved into what Berselius considers as a haloid salt, by being presented to oxybases. How, then, does it happen that this decomposition does not ensue on the presentation of the chloride of hydrogen to the hydruret of acetyl? How does it arrive that the hydrochloric acid forms chlorides with metals, while in this ethereal compound it forms a veritable hydrochlorate? Is it in the latter, or in the former case, that it has a true acid reaction? According to my apprehension, it is only in the latter that it acts as an acid, but not as a hydracid. It performs, as I infer, the part of a chloro-acid, and combining with a chloro-base, the resulting combination may be correctly called the chlorohydrate of the chloride of acetyl.

27. In the next place, let attention be given to the inquiries contained in the following language of Liebig:—

"But how, we may ask, are these so-called anhydrous acids known? Can we exhibit them without this water of hydration? The following strange answer is returned to this question by the adherents of this theory:—the innumerable acids which we call anhydrous, exist only in imagination; they are quite unknown; they cannot be shown to you."

28. Although agreeably to Liebig's work upon organic chemistry, nature is prolific of compound radicals, which for the most part have never been isolated, although *none* of those whose existence is assumed by the salt radical theory have been isolated, yet agreeably to his language above given, the fact that *some* of the anhydrous oxacids cannot be isolated, is treated as an objection fatal to their existence altogether.

29. The decomposition of chlorate of potash in aqueous solution, by sulphate of the protoxide of iron, is represented as a case in which protoxide of iron overcomes the affinity of potassium for oxygen, treating the paramount affinity of chlorine for that metal as a consideration which could only be insisted on "for the sake of argument."

30. Agreeably to the salt radical theory, in each of the oxysalts, of which the reaction is the subject of the preceding paragraph, there is a salt radical (oxysulphion in the sulphate, oxychlorion in the chlorate), yet chloride of potassium is the result of the process, no less than if potash were subjected to muriatic acid. Admitting that in the reaction of this last mentioned acid, the formation of the resulting chloride is due to hydrogen, how comes it that notwithstanding the absence of this *capacity giving* element, we obtain a chloride of potassium? What indication is there of the presence of oxychlorion or oxysulphion?

31. The resolution of sulphate of potash and cyanide of potassium, when fused together, into cyanate of potash and sulphuret of potassium, is by Liebig mentioned as an instance in which "potassium reduces potash," an inference which is erroneous: first, because potassium cannot take oxygen from its own protoxide; secondly, because the affinity of the sulphur for that metal, the most powerful force engaged in the whole process, is overlooked; and, thirdly, because the potash is not reduced, but on the contrary, unites with the cyanic acid formed by the union of the oxygen of the sulphuric acid with cyanogen.

32. Under the circumstances in question, agreeably to the old doctrine, three atoms of oxygen, one of sulphur, one of cyanogen, one of potassium, and one of potash are present. The sulphur seizes the potassium, the oxygen for the most part unites with the cyanogen, forming cyanic acid, which combines with the potash. This is just what ought to take place, consistently with the premises.

33. But, according to the new doctrine, the agents being one atom of oxysulphionide of potassium, and one atom of the cyanide of the same metal, the result is precisely such as to justify the impression, that the pre-existence of oxysulphion in the sulphate, and the generation of oxycyanion in the resulting cyanate, are imaginary.

* Liebig's Gregory's Turner, p. 896.

34. It is advanced by Liebig, agreeably to a table which he gives, that there are seven salt radicals, consisting of sulphur variously oxidised; and it is remarkable, that anhydrous sulphuric acid SO^3, is treated as the compound radical of sulphurous acid. Were this correct, anhydrous sulphuric acid ought to produce sulphites on contact with metals in the metallic state.

35. Alluding to the old opinion of the constitution of salts, Liebig inquires: "upon what does the power of saturating an oxygen acid depend, according to this theory: whence proceeds neutrality? Why is it necessary that for every equivalent of oxygen in the oxide, an additional equivalent of the so-called anhydrous acids must be present?"

Replying to the latter of these inquiries first, I refer to the facts above adverted to by me (par. 22), that in the case of the peroxides of the metals, of the alkalies and alkaline earths, each additional atom of oxygen does not give the power of combining with an additional equivalent of acid. Moreover, in the case of the metaphosphates adduced by the author, an oxide in the tribasic phosphate has the power, without any addition of oxygen, to unite with three times as much acid as in the monobasic phosphate.

36. I will also again call attention to the fact, that although neither the peroxide of potassium nor that of sodium will unite with even one equivalent of sulphuric acid, either of the protoxides of those metals may combine with two equivalents of that acid, so energetically as to be fusible without decomposition into a dry mass: I allude here especially to the well-known bisulphate of potash. I have already animadverted upon the fallacy of assuming that muriatic acid gives a bichloride on meeting with a binoxide, only in consequence of the presence of two atoms of oxygen in the latter, (17, &c.)

37. There does not appear to me to be any more difficulty in assigning a reason for the union of an oxybase with an oxacid, than in accounting for the union of the radicals, entering respectively into their composition, with oxygen.

38. The more any two bodies differ in their electro-chemical habitudes, the greater is their reciprocal affinity. Hence as potassium is strongly electro-positive, while oxygen is strongly electro-negative, they unite with an energetic affinity. But as potassium is more electro-positive than oxygen is electro-negative, in combining with oxygen it produces an electro-positive oxide. On the other hand, oxygen being more electro-negative than sulphur is electro-positive, on combining with it forms oxides which are electro-negative. Hence an affinity prevails between the oxacids of sulphur and the oxybase of potassium, which though less energetic than those existing between oxygen and sulphur, is founded on a similar electro-chemical diversity.

39. "Do you find," says Liebig, "any of the characteristic properties of hydrogen acids in chromic acid, boracic acid, silicic acid, titanic acid, or their combinations with oxides?"

40. In the interrogation here quoted, the author of a new, vague, and undefined idea of acidity, appeals to that idea in support of a nondescript innovation. Is it not surprising that it should not be perceived that the inquiry would be more justifiable if reversed; and that all claims to the acid character on the part of the hydrurets alluded to, might be denied upon the ground that they are deficient of that all-important property of combining with oxybases, on which the claims of oxacids to the acid character has been considered as dependant? In consequence of the deficiency of this attribute, the quadroxide of nitrogen NO^4 has been treated of by Berzelius as unworthy of a place in the class of acids; and in a letter to me, this great chemist admitted that he had been inconsistent in overlooking this deficiency in the case of the hydrogen acids or "hydracids," erroneously so called.

41. That the oxacids enumerated in the words last quoted, should have none of the properties of hydrogen acids after presentation to oxides, is precisely what occurs when hydrogen acids are presented to oxides agreeably to the following allegation of Liebig:—"The hydrogen compounds possess an acid character which is destroyed by the substitution of a metal for hydrogen." Thus the oxides are expected to acquire, in combination, properties of hydrogen acids; which, under circumstances, treated as analogous by the author, those acids do not themselves retain, agreeably to his own representations.

42. Liebig inquires, how, consistently with the old doctrine, is it to be explained, "that the amount of oxygen *in a base* determines its power of neutralisation?" Having shown that it does not have this effect in the instance of oxides formed with some of the most energetic metals (18), I beg to know how it is that the amount of hydrogen which is not in union with a body, can regulate its susceptibility of neutralization? (20.)

43. Again, "we want to know," says Liebig, "upon what constituent of the acid its capacity of neutralizing the alkaline properties of basis depends?" In reply to this query, I would ask, what reason is there for supposing that the property of neutralization

is dependant on any constituent in particular? Agreeably to my opinion, this property depends upon an electro-chemical diversity existing between the electro-negative element and the electro-positive radicals, severally of the acid and base. This diversity is not so completely neutralized by the chemical union to which these compounds owe their existence, as not to leave between them an analogous diversity sufficiently powerful to endow them with that difference of relation to the voltaic poles, which is the only true and universal test of what I would call acidity and basidity. It is thus that I would account for the power of oxacids and oxybases to unite so as to produce to a greater or less extent reciprocal neutralization.

44. Agreeably to Liebig, "salts are combinations of simple or compound radicals with metals, corresponding in composition with the degrees of oxidation of the latter." If there be any known compounds which are pre-eminently entitled to be designated as salts, would it not seem that chloride of sodium and those of the haloid compounds which are its congeners in properties and composition belong to that class? I have, however, objected to extending the designation to such haloid compounds as utterly differ from chloride of sodium in properties, however analogous in composition; such, for instance, as the fuming liquor of Libavius, the butyraceous chlorides, plumbum corneum, luna cornea, fluoride of calcium, and the gaseous haloid hydrates, treated as hydracids by Liebig. It has appeared to me that a salt properly means a body having some analogy in properties with common salt, the original type of the genus. I have urged that these oxides, in this respect, were entitled to be considered as salts than some of the compounds formed by the salt-protoning class of Berzelius. But according to the definition above quoted, common salt (chloride of sodium) is a salt only because it contains the same number of equivalents of chlorine that sodium does of oxygen; and the haloid congeners of common salts are salts only because their metals unite with oxygen, in the proportion in which their halogen ingredient enters into their composition. Were oxides viewed as salts by Liebig, there might be some consistency in considering other bodies results, so far as they might have an analogous composition; but in the actual state of the case, the definition seems to be unjustifiable. Under this definition, how are the sulphides, selenides, tellurides, phosphurets and carburets to be excluded from the class of salts, when consisting of a metal, united with either sulphur, selenium, tellurium, carbon, or phosphorus, in the same proportion as oxygen is capable of combining with the same metal.

45. Liebig refers to the electrolytic experiments of Daniell for support, but these were sufficiently shown to be negatory, in an essay published in the *American Journal of Science and Arts*, vol. xlv, for 1843. See also *L. E. Phil. Mag.* vol. xxiii, p. 263.

46. It would indeed be miraculous if all the seven compound radicals existing in the oxacids of sulphur, according to his table (34), should prove to be anions, on subjecting their compounds to electrolysis.

47. There is something in the reaction of muriatic acid with alumina and likewise magnesia, and of water with chloride of aluminum, through which an appeal is made in favour of the existence of salt radicals. I shall not, however, prolong the discussion, and render it more abstruse and unpalatable, by entering upon these mysteries. I have said enough to prove that the new doctrine is founded in misapprehension and false reasoning; and should there be some difficulties agreeably to the old doctrine, it is pretty evident that the salt radical theory will not enable us to get out of them.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

GENERAL RULES FOR THE QUANTITATIVE ANALYSIS OF SOILS.

BY ISAIAH DECK,
(Analytical Chemist, Leamington.)

Let the soil be well dried in a warm place for four or five days, then sift it through a coarse sieve, and then weigh out 500 grains, which is the most convenient quantity to examine; taking care that all results are divided by 5 to reduce it to the per centage. Heat this 500 grains to from 240 to 280°, for half an hour, in an oil-bath, stirring occasionally. Weigh, the loss is moisture. Heat the remainder to low redness in a crucible for half an hour, so as to burn it well. Weigh, when cold—the loss is organic matter.

Boil in a large flask for eight hours, with 8 oz. pure muriatic acid, and 2 oz. water,

constantly adding when boiled away, till about 6 oz. is left; filter while hot on a weighed filter; wash well with distilled water, until the washings are not acid; and then dry, ignite and weigh residue, which is almost pure silica, or sand, with silicate of alumina.

The solution contains oxide of iron, manganese, alumina, lime, phosphoric acid, magnesia, &c.

Saturate this solution with ammonia, which precipitates alumina, oxide of iron and phosphate of lime; keep the bottle stopped to prevent the conversion of lime into carbonate; pour off clear, and add distilled water; shake up well, keeping the bottle well stopped, and again pour off, and wash again: filter on weighed filter covered over, and wash well; add all the washings to solution and dry to about the firmness of butter. Remove with spatula, and digest with heat in solution of potash for an hour; this dissolves the alumina, leaving the phosphate of lime and oxide of iron. Filter while hot on the same filter, which retains the phosphate of lime and oxide of iron. Wash well, and add the washings to the solution of alumina in potash. Saturate this with muriatic acid, to redissolve the alumina at first precipitated, then add excess of ammonia. This precipitates the whole of the alumina, which filter, wash, dry, ignite, and weigh. The oxide of iron and phosphate of lime on the filter can either be well dried and weighed in conjunction, or separated with alcohol diluted with 2 parts water, and acidulated with 40 drops of sulphuric acid to the ounce. This must be poured warm into the filter and back again two or three times; it dissolves the oxide of iron, and leaves the sulphate of lime, into which it has converted the phosphate. Dry this, ignite and weigh; 5 parts correspond to 4 of the phosphate. The iron in solution in the alcohol can be precipitated with ammonia. Filter it, wash well, ignite, and weigh. The solution still contains the manganese, if present, and the lime which existed in the soil as carbonate, and the magnesia. To separate lime, add solution of oxalate of ammonia (taking care that the liquid is alkaline, as oxalate of lime is soluble in acids), boil for a few minutes, and set aside in warm place for four or six hours. Filter, wash, dry, ignite and weigh—pure carbonate of lime remains. The magnesia is separated by adding a solution of caustic soda; washing, drying, igniting and weighing—pure magnesia remains. The manganese is to be precipitated by adding a solution of hydrosulphate of ammonia, which gives a flesh-coloured precipitate; dark brown f iron is present in conjunction. Wall wash the precipitate, and pass muriatic acid through, and add carbonate of potash to solution. Filter, dry, ignite and weigh 100 grains—93 of protoxide of manganese.

For determining the amount of sulphate of lime which may yet exist, boil 300 grains of the soil with 1 pint of water, with about 80 or 90 grains of sal ammoniac. Filter and evaporate down to 2 oz., and add 1 oz. of alcohol. The sulphate of lime directly falls, and may be collected on a filter, dried and weighed.

To determine the quantity of chlorides of potash and soda, boil 300 grains with 10 oz. of water for two hours. Filter and wash well and precipitate chlorine with nitrate of silver. Wash, dry, ignite and weigh. 50 grains are equal to 22 of the mixed chlorides of potash and soda.

ON THE COMPARATIVE NUTRITIVE POWERS OF GREEN AND DRY FODDER FOR CATTLE, &c. &c.

BY M. BOUSSINGAULT.

On the 27th of April, a communication on the above subject was read before the Paris Academy of Sciences. Hitherto, the received opinion was, that natural or artificial grasses, on their being converted into hay, lost a portion of their virtues. To determine the point, M. Boussingault fed a heifer alternately, for ten days at a time, upon green or dry food, and weighed the animal after each ten days. He found no difference in the average weights; and therefore came to the conclusion, that the hay made from any given quantity of natural or artificial grass has the same nutrition as the quantity of green food from which it is made.

A paper was also received by M. Faucille, on the means of enabling persons at work in mines, pits, reservoirs, &c., to continue their operations without danger or inconvenience from the carbonic acid gas which is found where there is not a free current of air. The means adopted by him are simple, and are based on the fact that this gas is rapidly absorbed by steam. He connects a hose or pipe, having its open end in the mine, pit or reservoir, with a steam-boiler of any kind, and thus sends a supply of steam into the place where the gas exists.—M. Durand made another communication relative to his experiments, with a view of confirming his discovery of the cause of the roots of plants striking downwards. These leave no doubt that the roots shun the action of light; and that this is the cause of their pressing their way into the earth.—A paper on the effects

of calcareous salts in potable water was received from M. Dupasquier. He states, that all the calcareous soluble salts, with the exception of the bicarbonate of lime, are injurious to the stomach, and also harden the vegetables which are cooked in the water containing them. The bicarbonate of lime, however, produces no bad results; and is, on the contrary, favourable to digestion, in the same way as the bicarbonate of soda.

ON FERMENTATIONS AND THE IMPORTANCE OF THEIR STUDY BY THE MEDICAL PRACTITIONER.*

BY DR. A. BOUCHARDAT.

THE action of ferments on organic matters offers to chemists and physiologists, a field of study as interesting as it is fruitful. When the questions which are connected with this vast subject are better understood, medical men will find in it very natural explanations of facts, the interpretation of which has not hitherto been attempted; and the treatment of many diseases will become, I hope, more rational and more certain. The great physicians of the past ages, Stahl and Boerhaave, were well aware of the *avenir* reserved to the history of fermentation, but science was then only in its infancy, and even now the most simple questions connected with it are subjects of controversy. I shall, in the first memoir, by reuniting known facts, by bringing forward new ones, and by supporting our statements by the results of new experiments, discuss the nature of alcoholic ferments, and I shall endeavour in the first place to establish the fundamental opinion of their existence as organised and living beings.

I shall then examine the history of the fermentations, in which the existence of organised and living beings does not appear to me to be indispensable to the realisation of these wonderful transformations, which are always effected under the influence of an infinitely small quantity of a special azotised matter. These modifications resemble, in more than one sense, that which certain noxious principles, known by the names of virus and miasm, exert on the living economy. We touch in that point on a subject which approaches the highest questions in pathology.

In the second memoir, which is devoted to the study of the transformations of salicine, phloridzine, and amygdaline, under the influence of the azotised principle of almonds, will be found facts which I trust will throw a considerable light on the action of medicines on each other, and which should have an important *avenir* in therapeutics and pharmacology.

The facts comprised in the third memoir on the transformation of starch into sugar will serve as the basis for a positive theory of digeation, and to explain the nature of a disease which for many years has been the subject of my constant study, viz., glucosuria or diabetes mellitus.

I shall hereafter, if my strength will allow me, continue these researches on the fermentations, which I repeat, in concluding this short preamble, will sooner or latter open a new era in medicine.

In 1832 I published a first memoir on ferments and fermentations. Since that period this part of science has taken a new and fruitful direction, in consequence of the valuable observations of M. Cagniard-Latour, and of the labours of Turpin, Quevenne, Mitscherlich, &c. I am now about to resume my researches, which have been so long suspended.

My object in the memoir which I have the honour to present to the Academy of Sciences is, 1stly, to make known two species of alcoholic ferments distinct from the yeast of beer; 2ndly, to present an important discussion on the nature of these organised beings; 3rdly, to indicate the applications to rural economy which may be drawn from these researches, to arrive at the most favourable conditions for the fermentations of wines and other alcoholic liquors.

FERMENT OF BEER.

This has been thoroughly studied by Messrs. Cagniard-Latour, Quevenne, and Turpin. I shall give a *resumé* of its characters by-and-bye.

The authors, who in France have written on alcoholic fermentation, admit the unity of ferments, whether they are derived from the yeast of beer, or from the fermentation of the grape. In Germany, and especially in Bavaria, they distinguish two kinds of ferments of beer—the ordinary yeast, and the ferment obtained by deposition. Messrs. Liebig and Mitscherlich insist on this distinction, which, speaking practically, is very important, for it allows of the preparation at the will of the manufacturer of light beers, which will not keep, and of strong beers, which may be preserved a long while. The strong beer of Bavaria is not prepared in France; it is not, therefore, astonishing that attention has not been drawn here to the difference of those alcoholic ferments, and to the accessary circumstances which

* *Med. Times.*

are indispensable to produce this particular kind of drink. The two ferments which I am about to describe, greatly resemble the ferment of deposition of Bavaria; it is not even impossible that the one of which I shall speak is identical with it.

FERMENT OF LEES.

The following are the conditions in which I obtained the ferment of lees. In a small barrel, in which there were about forty pounds of white Bourdeaux wine containing 10·5 per cent. of alcohol, I added four pounds of sugar, and two pounds of alcohol at 85°. The whole was set aside at a temperature varying from 50° to 54° F. Four months afterwards the liquid was limpid, all the sugar had disappeared; and at the bottom of the barrel I found half a pound of a very homogeneous lees of a gray colour.

I obtained twenty-two pints of wine, containing 13·80 per cent. of alcohol; all the sugar had therefore been converted into alcohol and carbonic acid, without any loss: for theory indicates 13·86 per cent. of alcohol, admitting that sugar yields 25 per cent. of alcohol, and bearing in mind the quantity (0·850) of real alcohol which had been added.

Having obtained a ferment which would still act on sugar in a liquid containing more than 13 per cent. of alcohol, I thought it would be interesting to make it the subject of an attentive examination.

The first question it was requisite to resolve, was to find the means of producing this energetic ferment at will. With that view I placed in the same barrel fifteen quarts of a strong decoction of malt, half a pound of ferment collected in the preceding experiment, and eights pounds of sugar; it was all mixed well together, and set aside at a constant temperature of 52° F. As in the preceding experiment the progress of fermentation was exceedingly slow; it was not completed until after the lapse of six months, at which time all the sugar had disappeared; the liquid was very limpid, and charged with carbonic acid. The ferment was completely precipitated. The amount of alcohol contained in the beer was carefully ascertained; it was 15·17 per cent.—a considerable amount, far exceeding that which is obtained with the ordinary yeast, and which approaches the limits of our wines, which are richest in alcohol, as may be seen by a table which will be given by and bye.

The quantity of yeast obtained was so much increased that it was easy for me then to multiply it at will by means of successive fermentations.

The following are the characters of the lees-ferment.

Taken altogether, it presents itself in the form of a gray mass, greatly resembling in colour and unctuousness the ordinary yeast. If we had not already as its characteristic the very remarkable property of causing only a slow fermentation, and of acting in liquors strongly charged with alcohol, the microscope would enable us very clearly to distinguish this ferment from the ordinary yeast of beer. It presents itself in fact in the form of either round or slightly ovoid globules. The round grains are above 1-220th in diameter; the ovoid grains are 1-114th in length, and 1-288th in width.

It is impossible, when it is regarded comparatively with the yeast of beer, to confound the two ferments. That of the lees is always in much smaller globules; the largest globules of lees-ferment are not equal in size to the smallest of the beer-ferment. This character is not accidental, but these globules are regenerated in slow fermentations with a constancy of identical properties as great as in the fermentations of ordinary beer.

The regularity of the globules composing the lees-ferment, is also much greater than that of the beer-ferment. They appear to be much more organised, and offer greater resistance to the cause of destruction.

The greater number of the globules of the lees-ferment are isolated. Some, however, have smaller globules on the side, which appear to spring from the large ones; but this occurs much less frequently than in the beer-ferment. The globules of the lees-ferment are composed of a granular mass contained in an envelope of considerable resistance, as M. Mitscherlich has remarked. The lees-ferment, when in the form of dry paste, still retains 72 per cent. of water, which may be removed by a carefully managed desiccation. The lees-ferment is insoluble in pure water; it is also completely insoluble in water containing 1-1000th of hydrochloric acid. Concentrated hydrochloric acid dissolves it, and assumes a beautiful blue-violet colour, an important characteristic of proteic substances.

If the lees-ferment is digested with boiling ether, that menstruum removes from it about 0·05 to 0·07 of fatty matter, (the ferment being supposed to be in a dry state). This fat is semi-liquid, and of a yellowish colour; it reddens litmus paper. Expressed between leaves of filtering-paper, this fat leaves a solid part which melts at 96° F., and which on saponification, yields margaric acid. The oily part which is imbibed by the paper, is taken up by ether: it is a yellow oil, liquid at

32° F., with an acid reaction; on its destruction by nitric acid, it yields phosphoric acid.

Alcohol removes from the lees-yeast extractive matters of a yellowish colour, containing phosphoric and lactic acids, as M. Quevenne has observed in the beer-yeast. The sulphuric, phosphoric, and nitric acids, in concentrated solutions, disorganise the globules of the lees-ferment.

The concentrated solutions of the fixed alkalies (potash and soda) act scarcely at all, when cold, on the lees-ferment; but they are disorganised by boiling. The action of ammonia, even when concentrated, is much more feeble.

The dry lees-ferment when destroyed by calcination, yields three per cent. of ash, composed of phosphate of lime and magnesia, and of carbonate of lime.

En resumé, the lees-ferment possesses almost all the properties of beer-yeast; it differs from it, 1st, in the size of its globules; 2ndly, because it determines a slow fermentation; and, 3rdly, because it lives and acts in liquids containing 15 per cent. of alcohol.

BLACK FERMENT.

I am about to describe a ferment remarkably by its physical characters, by the conditions of its formation, and by the power of the alcoholic products which it may yield; it is a lees-ferment, but one which may be readily distinguished at sight merely, from the precipitated ferment of the Bavarian brewers. This product was also first discovered in a white wine. I have observed it in the wine of a single locality, and during two years only; but I am certain that this ferment will be discovered in several of our light white wines.

Some white wine of Nanchévre, near Vezelay (Yonne), of the year 1841, was drawn off in the month of March, and sent to Paris in new casks; when it arrived it was very clear. It was preserved in this state for two months, and then bottled, without being fined, and it was immediately stoppered with a great deal of care. It was perfectly clear, and its flavour was fresh and agreeable; it contained 9·99 per cent. of alcohol. I was very much astonished two days afterwards, on uncorking a bottle, when, instead a clear and agreeable wine, I saw only a turbid liquid, of a blueish-gray colour, and of a savour as unpleasant as its colour. I could not detect any distinct globules in it with the most powerful microscope.

Previous experience had taught me that sick wines which have not turned sour, and which contain a good proportion of alcohol, may, in the course of time, completely recover, when they are kept in well stoppered bottles, and placed in a very airy cellar. I left this wine in that state; sixty days after, the precipitation was incomplete, the liquid was still turbid. After the lapse of four months, it was perfectly transparent, and was more charged with carbonic acid than when it was bottled. Its proportion of alcohol was 10·25. Slow fermentation had therefore taken place in the bottles. A small precipitation had taken place, limited to the part of the bottle that was lowest; it is remarkable on account of its blackish-gray colour. When examined under the microscope, it appeared to me to be formed by the reunion of very distinct globules, nearly resembling the globules of the beer-ferment, but differing by two well marked black circles, and differing also in their dimensions; their diameter was about 1-250th of a millimetre, whilst that of the globules of the beer-yeast is 1·120 of a millimetre.

The external envelope is also less resisting than that of the ferment of beer or of lees.

I placed these ferment-globules in sugared water; at the temperature of 68° F., they did not induce the alcoholic fermentation; but they became disorganised, and produced the viscous fermentation, that is to say, the transformation of the sugar into a gummy mass and lactic acid. From this it might be supposed that this black ferment is not an alcoholic ferment, but a mucous ferment. We shall see further on, that this supposition cannot be admitted; for on placing it in appropriate conditions, it determines the transformation of sugar into alcohol and carbonic acid. If, when added to sugared water at 68° F., it caused the mucous fermentation, it was because it was destroyed (as demonstrated by microscopic experiments), and it was a substance resulting from that destruction which caused the transformation of the sugar into a gummy matter and lactic acid. The envelope of this ferment has so little resistance that it not only yields to mechanical efforts, but it is in the course of time attacked by pure water, and very rapidly by water acidulated with 1-1000th of hydrochloric acid. The same ferment, placed in appropriate conditions, may become more powerfully organised, and not only resist the decomposing action of sugared water, but also act on the sugar as a very energetic alcoholic ferment. The following experiments will prove this:—

Forty quarts of the same wine of Nanchévre, of the growth of 1842, were fined with a solution of five drachms of gelatine in

a quart of water. It was then set aside for three months. The wine was perfectly clear, (and so continued, not becoming turbid as in the previous instance) and about a quart of blackish-gray lees was precipitated, which was almost entirely composed of black ferment as was proved by microscopic examination. Twenty quarts of this wine were mixed with the quart of lees, and six pounds of sugar. The barrel containing this mixture was kept at a temperature which never exceeded 52° F. A slow fermentation gradually took place, which did not terminate until after the lapse of five months, and even then the whole of the sugar was not decomposed. But the liquid possessed an amount of alcohol superior to that of our most generous wines, for it contained 16·64 per cent.; among the numerous specimens of wines which I have analysed, I never found so large a proportion of alcohol; the richest, that of Bagnols, contained 15·16 per cent. of alcohol.

The black ferment which caused so intense an alcoholic fermentation is powerfully organised; it is not destructible either by pressure or by the use of water acidulated with hydrochloric acid. Taken in mass it appears in the form of a *bouillie* of a very remarkable blackish-gray colour.

When examined under the microscope, it offers no less prominent characters. It is composed of perfectly regular globules, well characterised by the black circle which limits them, and by the uniformity of their dimensions. Their diameter is 1-250th of a millimetre. It is the smallest of the three alcoholic ferments. It is also the most energetic, if we consider only the richness of the alcoholic liquors which it can produce; but it is the least energetic of all, if we take into consideration the rapidity of action only, for whilst the alcoholic fermentation caused by the beer-yeast is completed in a few days, at least four months are required, before the action of the black ferment is exhausted.

The black ferment possesses besides the essential properties and the composition of alcoholic ferments, as may be seen in the following *resumé*, reuniting the characters and essential properties of these organised beings.

FERMENT OF BEER.

1st. Globules sometimes perfectly round, but generally ovoid. These globules are not flattened like those of the blood, but have a tolerably regular spheroidal form like the albuminous globules of the brain. The diameter of these globules has varied, in my observations, from 1-91 to 1-150th of a millimetre in diameter.

2nd. The larger number of the globules of the beer-ferment are fully isolated from each other; some, however, have on one side a smaller globule which is not merely in juxtaposition with it, but which appears to proceed from the large globule, and to be dependent on it; some of the smaller globules are united to the larger, by a small, but well-marked prolongation.

3rd. The colour of the mass is uniformly whitish-gray; each globule contains a granule.

4th. It is insoluble in pure water; insoluble in water containing 1-1000th of hydrochloric acid, and soluble in concentrated hydrochloric acid, which assumes a beautiful violet colour. It is in a great measure soluble in water, containing 0·001 of hydrochloric acid, after having been bruised for a long while with grains of silica.

5th. Ether removes about 0·05 of a liquid fat body, containing oleine, stearine, and an oil which contains phosphorus among its elements.

6th. Alcohol takes from it lactic and phosphoric acids, and extractive matters.

7th. *Composition.*—Albuminous matter, but containing more oxygen, and also containing sulphur and phosphorus.

8th. *Essential properties.*—Placed in sugared water at a temperature from 50° to 86° F., it causes a lively fermentation, which terminates in a few days, and has no action on liquids much charged with alcohol. It is destroyed in the act of rapid fermentation.

9th. It is collected from ordinary beer.

LEES-FERMENT.

1st. Globules most frequently perfectly round, some nevertheless being ovoid; they are not flattened like those of the blood, but have a tolerably regular spheroidal form; they infinitely resemble the albuminous globules of the brain. The diameter of these globules varies from 1·114 to 1·228 of a millimetre.

2nd. Almost all the globules of the lees-ferment are isolated. Some, however, have on the side a smaller globule, which is not merely in juxta-position, but which appears to proceed from a larger globule, and to be dependent on it.

3rd. The colour of the mass is uniformly of a whitish-gray; each globule contains a lobule.

4th. Insoluble in pure water; insoluble in water containing 1·100 of hydrochloric acid; soluble in concentrated hydrochloric acid, which assumes a beautiful violet colour. Is in a great measure soluble in water; containing 0·001 of hydrochloric acid, after

having been bruised for a long while with grains of silica.

5th. Ether takes from it about 0·05 of a liquid fatty body containing oleine, stearine, and an oil which contains phosphorus among its elements.

6th. Alcohol takes from it lactic and phosphoric acids, and extractive matters.

7th. *Composition.*—Albuminous matters which contain more oxygen, and also sulphur and phosphorus.

8th. Placed in sugared water at a temperature from 50° to 54° F., it causes a slow fermentation, which does not terminate until after the lapse of three or four months. It lives and acts in liquids containing 16 per cent. of alcohol. It is not sensibly destroyed in the act of slow fermentation.

9th. It is collected from very strong beer.

BLACK FERMENT.

1st. Globules perfectly round; they are not flattened like those of the blood. The dimensions of these globules vary from 1-228th to 1-250th of a millimetre.

2nd. All the globules of the black-ferment are isolated; when they are elongated, or when they have small globulines annexed to the side, they are transformed, and no longer act as alcoholic ferments.

3rd. Examined under the miscroscope, the globule presents a well-marked black circle. The colour of the mass is uniformly blackish-gray. Granular contents cannot be distinguished in the globules.

4th. Insoluble in pure water; insoluble in water containing 1-1000th of hydrochloric acid; soluble in concentrated hydrochloric acid, which assumes a beautiful violet colour. In a great degree soluble in water containing 0·001 of hydrochloric acid, after having been bruised for a long while with grains of silica.

5th. Ether takes from it 0·003 of a liquid fatty matter containing oleine and stearine, and an oil containing phosphorus among its elements.

6th. Alcohol takes from it lactic and phosphoric acids, and extractive matters.

7th. *Composition.*—Albuminous substances, but containing more oxygen, and also sulphur and phosphorus.

8th. Placed in sugared water at a temperature from 50° to 54° F., it determines a slow fermentation which is not terminated until after the lapse of six months. It lives and acts in liquids containing more than 17 per cent. of alcohol. It is not sensibly destroyed in the act of slow fermentation.

9th. Collected in a precipitated state from white wine.

NATURE OF ALCOHOLIC FERMENTS.

The point which influences the question of alcoholic ferments is this:—are alcoholic ferments organised and living beings? We shall now endeavour to resolve that problem.

Immediate composition of alcoholic ferments.—The immediate composition of alcoholic ferments is constant, whatever their origin may be; this constancy, and the multiplicity of principles which enter into their composition would give rise to the suspicion that we had to do with organised beings.

The following is a list of substances found in ferments:—

1st. Proteic animal matter, insoluble in alcohol, containing nitrogen, hydrogen, carbon, oxygen, sulphur, and phosphorus. 2nd. An azotised matter soluble in alcohol. 3rd. Solid fat. 4th. Liquid phosphuretted fat. 5th. Lactate of lime and soda. 6th. Acid phosphate of lime, and phosphate of soda.

Elementary composition.—Ought the proteic animal substance which forms the essential part of ferments to be considered as a simple modification of albumen, casein, or fibrin? We shall compare these two substances in two different, but very important points of view. 1st. The elementary composition. 2nd. The action of water acidulated with hydrochlaric acid.

The following is the composition of the ferment, after purification from all soluble products by water, alcohol and ether; carbon 51·12; hydrogen, 7·06; nitrogen 15·22; oxygen, phosphorus, sulphur, 26·62. By their elementary analysis, the proteic matters of ferments differ therefore from casein, albumen, and fibrin, by an excess of oxygen which is not less than two per cent.

2nd. On the other hand, if we treat with water containing 1-1000th of hydrochloric acid, casein, albumen, fibrin, or gluten, we obtain at the end of twenty-four hours, a complete solution, so to say, as I have already stated. Moist ferment, placed in the same conditions, is in no way affected; it completely resists the solvent action of acidulated water. The globules of the ferment appear intact after the lapse of the twenty-four hours.

If the cuticle or epidermis of the globules of ferment has been carefully broken, by beating them on a slab with fragments of silica, before treating them with water acidulated with 1-1000th of hydrochloric acid; and if, after the twenty-four hours have elapsed, the liquid is filtered, we may ascertain by means of nitric acid, tannin, or prussiate of potash, that we have a solution possessing the properties of the solutions fur-

nished under the same circumstances by albumen, casein, gluten, or fibrin.

Do not these two experiments—1st, the nullity of action of the acidulated water on the intact globules; and, 2nd, the action of the same water on the globules, when lacerated by porphyrisation—lead to the following conclusions?

The proteic matters of the globules of ferment differ from casein, fibrin, gluten, and albumen; they are constituted by two different substances, the one enclosed, soluble in acidulated water; the other, the envelope, insoluble in that liquid. This cuticle or enveloping substance resembles the epidermis of animals in its insolubility in water, slightly acidulated. If this analogy be fortified by additional proofs, we could then easily understand why gluten cannot be primitively converted into a ferment, except by the absorption of the oxygen necessary to form this epidermis—a proteic matter more oxydised than gluten, and which possesses the important property of resisting the action of slightly acidulated water—a condition necessary to the existence of the ferment-globules.

Everything, in the chemical reactions, concurs to induce us to regard the ferments as composed essentially of organised globules. If there were any doubts in some minds as to this fundamental part of the history of ferments, three orders of proof might be brought forward:—1st, the microscopic examination; 2nd, the action of poisons; and 3d, the mechanical destruction of the ferment globules.

1st. The microscopic examination shows us clearly that we have not to do with an amorphous matter, incessantly modified by spontaneous decomposition, but with globules always resembling each other in the same species, and presenting a similitude of physical characters as great as in the best defined organised beings. Those who are in the habit of making microscopic researches will never call in doubt the existence of ferments, as composed of organised and living globules. The only objection that can be raised is this: the ferment-globules are developed in all liquors in a state of fermentation, and they accompany, but are not the determining cause of the transformation of sugar into alcohol and carbonic acid. This may be answered peremptorily, as follows: 1st. The development of the ferment-globules precedes all fermentation. No transformation of sugar into alcohol takes place without the presence of these globules; the decomposition is effected by the sole contact with these globules. 2nd. The action of almost all the substances which act as poisons on the lower orders of beings interrupts the alcoholic fermentation, and among these I may place hydrocyanic acid in an extreme degree of dilution in the first rank. This is one of the most decisive arguments in favour of the vitality of the ferment-globules. 3rd. If, instead of adding to sugared water the ferment-globules entire, they are previously bruised with fine sand, they do not immediately cause the conversion of sugar into alcohol and carbonic acid, and do not act until after the lapse of thirty-six hours and more.

Thus, *en resumé*, the microscopic examination, the action of poisons, and the mechanical destruction of the ferment globules, will, I trust, cause the opinion to be adopted that the alcoholic fermentation is caused by organised and living beings.

On the place which the ferment-globules ought to occupy in the organic series.—The organised nature of the globules of the alcoholic ferments being admitted, it now remains to discuss the place which they ought to occupy in the series, and to speak of their development.

Let us acknowledge, in the first place, that they are very singular beings; and present, in their existence, peculiarities which are not found in any other class of beings. In fact, this special aptitude which they possess of decomposing sugar so energetically is very remarkable; but that which is still more so, is their power of living in liquids, containing such high proportions of alcohol, and so supersaturated with carbonic acid. No plant nor animal, other than the alcoholic ferments, can exist in such a medium.

Ought we to range the ferment-globules in the animal kingdom, or ought we to consider them as having more analogy with the vegetable? We shall see that the precise solution of this question is surrounded by many difficulties.

Nothing proves that the ferment-globules possess motility and sensibility; these two properties are generally regarded as being the apanage of animal life. But, on the other hand, if we consider that the ferment-globules possess an elementary composition, which gives them a singular resemblance to the constitution of animals; if we remark, that the essential character of their existence is to decompose sugar into two simple bodies, with the production of heat—do we not perceive in these important animal characteristics?

If I add to this, that many animal globules may act as ferments, there will be good reason for considering ferments as belonging to the animal kingdom.

The following are the experiments on which is founded the assertion that animal globules may act as ferments.

I took twenty-five grammes of the brain of an adult man, diluted it with a quart of water, and added 250 grammes of sugar. After the lapse of forty-eight hours, the temperature being at 78° F., alcoholic fermentation had commenced, and it continued to make regular progress.*

At the first view, we should be tempted to regard this as only a fact analogous to those described by M. Colin (*Annales de Chimie et de Physique*, 28 and 30.) This chemist has, in fact, proved, that the white of egg, and many other organic matters, may become alcoholic ferments. But this constitutes the difference between the results obtained by M. Colin and mine. Albumen, in contact with sugared water, at the temperature of 92° F., is not converted into a true ferment until after the lapse of three weeks, and its action is then very feeble, whilst the cerebral mass of an adult acts after the lapse of forty-eight hours, as an energetic alcoholic ferment.

The substance of which the brain is composed, is formed by the reunion of globules of different kinds; among them, the most important are the albuminous globules which present the microscopic appearance of the lees-ferment, and which act like it on sugared water.

These globules are not composed of pure albumen, as has been hitherto supposed. In fact, if the cerebral mass of an adult be diluted with water, acidulated with 1-1000th of hydrochloric acid, this pretended albumen is not dissolved; to obtain its solution, it must be previously bruised with silica. These experiments show that the albuminous globules of the brain are formed like the globules of ferment, of an envelope insoluble in acidulated water, and an enclosed albuminous matter soluble in that medium.

If, instead of taking the cerebral mass of an adult animal, that of one newly-born be chosen, and diluted with sugared water, and the mixture exposed to a temperature of 77° F., alcoholic fermentation is not induced, but the mucous transformation is observed. The reason of this difference is very simple; the envelopes of the globules of the brain of a young animal are not resistant; they are destroyed by endosmosis in sugared water, and the globules being no longer in existence, alcoholic fermentation cannot take place.

The experiments which I have described in my memoir show that the proteic globules of the brain present a most complete analogy in regard to their microscopic aspect, organic composition, and the action on sugared water with the globules of the lees-ferment, which I have previously described. I may add, to complete this analogy, that the globules of the ferment (qy. brain, Trans.) like those of the lees, are accompanied by a phosphoretted fat.

Thus, everything in that which has been stated, concurs to show, that if we may not regard ferments as animals, we ought at least to look upon them as presenting the greatest resemblance to the nervous globules, which are among the most important organised parts of animals.

We will now examine the reasons which indicate the resemblance of ferments to mushrooms, or rather to algæ.

M. Turpin has very carefully watched the budding and development of the yeast of beer, which terminated by the production of the *penicillum glaucum;* but M. Turpin has not been able to prove that the *penicillum glaucum* could reproduce the ferment. Messrs. Andral and Gavarret (*Annales de Chimie et de Physique*, August, 1843), have seen, on the contrary, that this vegetable, placed in a solution of sugar, did not determine any movement of fermentation, and from this fact, they conclude "that the

* The fermentation was rendered more prompt and energetic by acidulating the solution of sugar slightly, either with tartaric or lactic acid.

It is known, that an acid is developed in all cases where the ferment is brought in contact with sugared water. It may be supposed that this acid acts by modifying the molecular condition of the cane sugar. M. Soubeiran has, in fact, demonstrated, that during the act of fermentation, the cane sugar is gradually converted into a sugar exercising a rotation to the left; acids, as is well known, act in the same manner on sugar; but it is probable, that during the fermentation of cane sugar, the globules of the ferment also intervene to give the cane sugar this peculiar modification; for a solution of sugared water, containing 1-50th of lactic acid, examined in a tube of 200, which had a power towards the right of + 81°, after three months' contact, did not even then exert the rotation to the left, but its power was no more than + 12°. During the first six weeks, the modification was very slow; but after that time it became progressive. Now, as fermentation is generally completed in the space of a few days, and the liquids contain less lactic acid than in the case just cited, it may be presumed that the globules assist in modifying the molecular action of cane sugar, and in changing the direction of its rotary molecular power.

yeast of beer contains two species of germs; the one being the agent of the alcoholic fermentation, and remaining always in the state of simple vesicles of greater or less size: the others do not play any part in this important phenomenon, and are the first rudiments of a vegetable which is developed in all acidified albuminous liquids.

According to this, we may refuse to admit the reality of a connection between these two states of the same being; the proofs afforded by M. Turpin (*Comptes Rendus des Sciences de l'Académie des Sciences*, 20th Aug., 1838; *Répertoire de Chimie*, Aug., 1838), have not appeared to be decisive to all observers; but the following new facts, supporting his opinions, appear to me to give additional weight to the hypothesis of the metamorphosis of ferments. Some black ferment which was deposited in well-corked bottles of the wine of Nanchévre, which still contained some sugar after its action was exhausted, became gradually modified; the globules became elongated, they furnished prolongations altogether analogous to those which constitute the first phase of the transformation into the *penicillum glaucum*; the globules thus transformed no longer possessed the property of exciting the alcoholic fermentation; and, nevertheless, their dimensions and colour showed that they were evidently connected with the existence of the black ferment. Does it not, then, appear more probable to admit, that, since the vesicles of the black ferment may be transformed into a species akin to the *penicillum glaucum*, not possessing the power of exciting fermentation, in the same way the beer ferment may be changed into the *penicillum glaucum*, also incapable of exciting fermentation. And ought we not, therefore, to distinguish, as M. Quevenne does (*Journal de Pharmacie*, October, 1842) two periods in the life of alcoholic ferments? We must insist in this point, for it regulates the question. As soon as the alcoholic ferment assumes the form of a vegetable, its existence as a ferment ceases. The microscopic vegetables which are derived from ferments, are not only unable to develop the alcoholic fermentation, but even their spores are no longer ferments.

Thus, to give, *en resumé*, the discussion on this difficult point in the history of ferments, we should say:—the globules of the alcoholic ferments present the most complete analogy with the nervous globules of the higher orders of animals. When, in definite circumstances, these globules ramify, and are changed into vegetable infusoria, they lose their character as ferments.

On the development and multiplication of the globules of ferments.—When perfectly limpid grape-must, or any other liquid containing the principles necessary for the development of fermentation, is exposed to the temperature of 68° F., if the liquid is not abstracted from the influence of oxygen, it becomes turbid, and often after the lapse of a few hours, before the commencement of fermentation; if examined under the microscope, globules of ferments are seen, pale at first, but rapidly increasing in number and colour. The decomposition of the sugar is effected with an energy proportionate to the number of the globules.

Must we admit that the germs of these globules existed in the grape-must, or in the perfectly limpid fermentable liquids? If these germs pre-existed, we must allow that they could not be discovered, even with the aid of the most powerful instruments.

If it be desired to refer only to those facts which are visible, it must be admitted that the oxygen, in re-acting on the proteic substances contained in the limpid fermentable substances, determines the formation of the globules of the ferment by the organization of those substances. The action of oxygen is easily understood, according to known facts. It forms, with the proteic substances, an insoluble compound; which, as we shall soon show, is an indispensable condition for the formation of the globules. In the second place, the elementary analysis of the proteic matters has equally shown that the epidermic substances which possess the valuable property of not being attacked by slightly acidulated liquids, are more oxygenated than the soluble matters. The intervention of the oxygen, therefore, admits of a very natural explanation.

But there is a difficulty presented by this method of viewing the question which requires additional researches. M. Gay-Lussac, to whom we owe the fundamental observation of the necessity of the intervention of oxygen gas in grape-must, has remarked, that a single bubble of oxygen is sufficient to determine fermentation; and that it then takes its normal development without a further intervention of oxygen. This feeble proportion of oxygen is evidently insufficient to modify all the proteic substances in grape-must and transform them into ferment; we must, therefore, suppose, that the remaining portion of the oxygen is supplied in another way, at present unexplained; and that the action having been commenced by the direct influence of oxygen, is continued by an indirect intervention.

I have just said that one of the first conditions of the development of the ferment-globules is the previous formation of an in-

soluble organic matter; I am about to describe an experiment which proves the correctness of this explanation, and which also shows on how slight a foundation has the previous existence of the ferment-germs in fermentable liquors been admitted. I dissolved two pounds of sugar, and the whites of four eggs in four quarts of water, containing 1-1000th of hydrochloric acid. The liquids were filtered most carefully, and poured into two flasks of equal size, stoppered with emery. I did not add anything to the first, and after the lapse of two months, the temperature varying from 59° to 68° F., alcoholic fermentation had not taken place. To the second flask I added an equally limpid solution of 10 grammes of tannin in 100 grammes of water. An abundant precipitate immediately resulted, which, after having been exposed for forty-eight hours to a temperature 76° F., was partly transformed into globules of 1-400th in diameter, and behaved with sugared water exactly in the same manner as the lees-ferment. Thus, in this experiment, the tannin by precipitating the albumen, caused, by the influence of the sugared water and a temperature of 76° F., its rapid transformation into ferment-globules.

We are now about to open a question, the solution of which appears to be simple enough at the first aspect, but which it is not less difficult clearly to resolve—can the globules of ferment reproduce themselves? When we examine, as M. Turpin did, what is going on in the brewer's vat, where one part of ferment is added, and seven parts are gathered, it seems as if we could reply no otherwise than in the affirmative. When, on the other hand, we notice the additional buds which are developed on the sides of several globules; when we admit the existence of internal globulines, it appears difficult to refuse to believe in the multiplication of ferment by means of spores, or globulines springing from the globules.

Let us now see what can be opposed to this presumptive evidence. If we begin with the latter, we shall say these internal globulines, which, by enlarging, should pass to the state of globules, should, during active fermentation, be observed of the most variable dimensions—from the smallest to the perfect globule. Well, I have never seen these globulines varying in size, nor has any observer pointed them out; all the globules are, with few exceptions, uniform in size.

With regard to the adherent globule, that is merely the first phase of the transformation of the globule of ferment into a vegetable infusoria; it is then no longer a ferment, but has entirely lost its property of inducing the transformation of sugar.

All chemists know, since M. Thénard performed his experiments, that when sugared water is caused to ferment by means of a sufficient quantity of ferment-globules, when the first fermentation is finished, the weight of the globules is notably diminished; after a second fermentation they have almost entirely disappeared, and are replaced by an ammoniacal salt which is found in the liquid, and by the *debris* of microscopic vegetables, in which M. Thénard has recognised the existence of lignine; but this observation cannot be brought forward to establish the non-reproduction of the ferment-globules. We may say that the ferment-globules have need of two kinds of food; sugar to produce heat by its decomposition, and azotised matter to furnish the elements necessary for their assimilation and reproduction.

The following experiment has reference to this latter supposition; I took two pounds of sugar, eight pounds of water, fifty grammes of yeast, and two hundred grammes of the white of egg, previously dissolved in the water by means of 1-1000th of hydrochloric acid, the temperature being sustained at 68° F. Fermentation took place rapidly, and continued to make steady progress during four days. Having then slackened, I collected the ferment, and found it weighed only 50 grains, 5. This is far removed from its multiplication in the brewer's vat. The ferment-globules could not in any way assimilate the albuminous matter nor the sugar.

But I shall perhaps be told that the white of egg, even when acidulated, may differ from the gluten of the cerealeæ, and that there is nothing astonishing in that it cannot serve for the nutrition and multiplication of the ferment-globules.

I repeated the preceding experiment, replacing the two hundred grammes of albumen by one hundred grammes of fresh gluten, also dissolved in water, acidulated with 0·001 of hydrochloric acid; and I also employed fifty grammes of yeast. Fermentation went on regularly for four days, after which the ferment, when collected, weighed only 49 grains, 2. So that it appears that the ferment-globules assimilated no better with sugared water than the solution of albumen, or than the solution of gluten.

Does it not result from these experiments that, if in the brewer's vat we find seven parts of ferment when only one was used, it depends solely on the fact that the one part of ferment has met with proteic substances which, placed in a fermenting medium, are capable of spontaneously pro-

ducing ferment-globules, in the same way as in grape-must, we find a considerable quantity of ferment although none has been added?

We still confound under the name of albumen or casein substances which differ greatly in their molecular constitution. When the history of fermentations is more advanced, it will show that many of these matters which we consider as closely resembling each other, and often as identical, behave in a very different manner when they are placed in conditions favourable for them to become organised, and to constitute the different ferments which I intend to study. Some may readily be transformed into special ferments; the others are altogether unfit for that purpose.

On the power which induces fermentation.—The decomposition of sugar in the alcoholic fermentation is undoubtedly a phenomenon of contact, for it does not take place without the contact of the globules; it is, in this respect, an action analogous to the decomposition of oxygenated water by the influence of fibrin, and of many other substances, by the influence either of platina in a state of division, or of pumice-stone, or other porous bodies; but that which characterises the decomposing action of ferments, is that it is intimately connected with the life of the globules. Destroy this vitality by ether, essences, hydrocyanic acid, any mercurial salts, &c., and fermentation immediately ceases.

Phenomena, analogous to those which are observed in alcoholic fermentation, take place during the act of assimilation in living animals, and the name of vital force has been given to the unknown cause of their production.

At the first view it seems very astonishing that ferment-globules should decompose in a few days a quantity of sugar ten-fold their weight; and one is led to believe that they may be useful in commencing the decomposing action, but that when once the equilibrum is disturbed, the decomposition of the sugar proceeds of itself in the same direction in which it began. It may be objected to this mode of viewing the question—1st, that the decomposition is never propagated beyond the contact of the globules; 2ndly, that it is not a complete return of the elements of the sugar to the inorganic state, but an intermediate decomposition, which is accompanied only by a moderate degree of heat—the action being only partial ought to be more extended; 3rdly, that which appears to be more decisive is, that when the quantity of ferment is not sufficient, the fermentation languishes and remains unfinished. This will be easily understood when we admit that this decomposition is the act of the vitality of the globules, but is explained with much greater difficulty by the hypothesis of the propagation of action.

I therefore believe that we must consider alcoholic fermentation as being under the absolute and complete dependence of the vitality of the globules of ferment.

(*To be continued.*)

ON THE EMPLOYMENT OF ESSENCE OF TURPENTINE AS A SOLVENT FOR CAOUTCHOUC.*

BY M. BOUCHARDAT.

About ten years since I was consulted by a manufacturer of waterproof fabrics, as to the best solvent for caoutchouc. At that time either essential oil obtained by distilling coal tar, or oil obtained by the open distillation of caoutchouc, was used in England.

I commenced by carefully studying the nature of this pyrogenous oil, and separated from it several kinds of carburetted hydrogen, remarkable by their point of ebullition being very low; I was not long, however, in being convinced, that if pyrogenous oil of caoutchouc is a good solvent of that substance, its cost will prevent its being for some length of time employed. The essential oil, obtained by distillation from tar, has a disagreeable smell, from which it is so difficult to free the fabrics, that I determined to find, if possible, another solvent.

From the first I thought of a natural carburetted hydrogen (essence of turpentine), which it is well known acts as a solvent of caoutchouc; I hoped that by modifying it by heat its solvent properties might be augmented—I was confirmed in this idea by experience. By distilling this essence openly, once or twice, a solvent is obtained which gives satisfactory results. I also remarked, that by effecting this distillation upon fire-brick, the essence being submitted to a higher temperature, a liquid was obtained which was very little inferior, as a solvent, to the pyrogenous oil of caoutchouc.

The manufacturer who had consulted me hastened to profit by the results which I had obtained, and having reserved the right of publishing them, I made them known in my treatise upon the products of distillation of caoutchouc, inserted in vol. 23. of the *Journal de Pharmacie*. Since that time,

* *Bulletin du Musée de l'Industrie*, and *Newton's Repertory*.

the essence of turpentine, modified by one or two open distillations, has been the solvent for caoutchouc employed by manufacturers of waterproof fabrics in both France and England.

The following are the physical properties possessed by essence of turpentine, obtained by open distillation upon fire-brick. Its colour is yellowish; its smell partakes of that of thyme, oil of naphtha, and essence of turpentine; it is lighter than the essence from which it was made, in the proportion of 0·8726 to 0·8420. Its boiling point is 185° F.; but the temperature rises immediately afterwards to 310°, and remains stationary at that point. I have inquired whether it was not possible to isolate the former more volatile portions; but, notwithstanding great care and the best refrigerating mixtures, I have only been able to separate a very small portion, insufficient for useful examinations. In general the improved essence has been found to boil at 310°, whilst before its distillation its boiling point varied from 312° to 316° F. I analysed the modified oil, and found that its composition was exactly the same as that of the primitive essence.

IMPROVEMENTS IN COVERING OR STOPPERING THE TOPS OF BOTTLES, &c.*

BY BENJAMIN WEST.

This invention consists in the application of the electrotype process for depositing metal around, upon, and over the upper surfaces of bottles, jars, pots, and other similar vessels, and the corks or other substances used therewith.

The following is the mode of carrying out this invention:—An electrotype apparatus, of a circular form, is constructed, and at or near the bottom of the vessel containing the sulphate of copper or other metal is placed a ring of copper or other metal, which is connected by a wire with the acid; upon the ring are placed, side by side, in an inverted position, the bottles, jars, pots, and other similar vessels, and in a short space of time their tops will become covered with a deposit of metal.

The patentee, in conclusion, says, "I claim, as my invention of certain improvements in covering or stoppering the tops of bottles, jars, pots, and other similar vessels, the application of the electrotype process for the purpose of effecting such covering or stoppering, in the manner herein described."

* *Newton's Repertory.*

IMPROVEMENTS IN THE MANUFACTURE OF BRANDY, GIN, AND RUM, AND OTHER BRITISH SPIRITS AND COMPOUNDS.*

BY W. BETTS.

This invention consists in employing sugar in combination with repeated distillations of the spirit diluted with water. For each one thousand gallons of spirit, of fifty per cent. under proof, about twenty-hundred weight of refined sugar, dissolved in water, is employed for each re-distillation; and for distilling the spirit, diluted with water and mixed with sugar, any suitable still may be used. This process of re-distillation is repeated until no flavour of the grain is discoverable, or to such an extent as the distiller may be satisfied with. Or, in place of mixing the sugar, dissolved with water, together with diluted spirit, in the still, the dissolved sugar may be put into vessels, and the spirit, in its passage to the worm tub or refrigerator, caused to pass into the sugar and water.

The spirit thus obtained is then treated and flavoured for making brandy, gin, and rum, and other British spirits and compounds, according to the judgment of the maker; but in making brandy, the patentee prefers that the same flavouring material used by the French makers should be employed.

IMPROVEMENTS IN THE MANUFACTURE OF EPSOM SALTS AND CARBONATE OF LIME.†

BY J. B. GREGSON.

These improvements in the manufacture of Epsom salts are two in number, and consist —1st, in the application of sulphuric acid to dolomite or magnesian limestone in the uncalcined state; and, 2nd, in the application of muriate of ammonia to remove the lime from the mixed hydrates of lime and magnesia, obtained by thoroughly calcining and slaking dolomite.

The following is the mode of carrying out the first improvement:—The dolomite is reduced to powder, and made into a paste with water, in an open vessel lined with lead; then sulphuric acid, of 1·500 spec. grav., is added in the proportion of 350 lbs. of the latter to 200 lbs. of the former, and the mixture is well stirred. The sulphuric acid rapidly decomposes the dolomite, and carbonic acid gas is liberated; and when the effervescence ceases, a solid substance re-

* *Newton's Repertory.*
† *Chemical Gazette.*

mains, composed of the sulphates of lime and magnesia; if desired, the carbonic acid gas may be collected for use, by mixing the sulphuric acid and dolomite in a close vessel. The mixed sulphates are separated by diffusing the solid residuum in water, allowing the sulphate of lime to subside, and drawing off the supernatant liquid, which is a solution of sulphate of magnesia (Epsom salts), containing a small quantity of sulphate of iron; this solution is freed from sulphate of iron by means of caustic lime or magnesia, and is evaporated and crystallised in the usual way. Or the mixed sulphates may be calcined in a reverberatory furnace for three or four hours, or until the whole of the iron is peroxidized; and, when this has been done, the sulphate of magnesia may be dissolved out of the mass, and the clear solution evaporated and crystallised.

The method of operating according to the second improvement is as follows:—200 lbs. of muriate of ammonia are dissolved in 100 gallons of water, in an iron boiler, by the application of heat, and the solution is allowed to cool; after which 200 lbs. of thoroughly calcined dolomite are slaked with water, and put into a iron still (holding from 200 to 400 gallons), connected with a Woulf's apparatus containing water; the solution of muriate of ammonia is then introduced, and a gentle heat applied to expel the ammonia, which is condensed in the Woulf's apparatus, and stored for use. When all the ammonia has come over, the residuum is withdrawn from the still, and the hydrate of magnesia thoroughly washed, to free it from muriate of lime. The magnesia is then saturated with sulphuric acid, the iron it contains is thrown down by means of caustic lime or magnesia, and the clear solution is evaporated and crystallised.

The improvements in the manufacture of carbonate of lime consist—1st, in the application of carbonic acid gas to a solution of caustic ammonia and muriate of lime, and in the recovery of the muriate of ammonia for subsequent use; and, 2nd, in adding a solution of carbonate of ammonia (obtained by saturating a solution of caustic ammonia with carbonic acid gas) to a solution of muriate of lime.

With regard to the first improvement, the operation is conducted in the following manner:—100 lbs. of muriate of ammonia are dissolved in 100 gallons of water, and the solution allowed to cool; 70 lbs. of well-burnt lime are then slaked in water, and when cold, stirred into the solution of muriate of ammonia in an earthenware vessel; mutual decomposition immediately takes place, and muriate of lime and caustic ammonia are formed in the liquid. This solution is transferred to a cylindrical vessel, lined with lead, and containing an agitator covered with lead; carbonic acid gas is then forced into the solution by means of a force-pump connected with the bottom of the vessel, and the agitator is kept revolving until the solution is entirely decomposed, which may be known by the smell of ammonia no longer arising. The vessel will now contain a milky fluid, composed of carbonate of lime and a solution of muriate of ammonia; this fluid is removed, and allowed to settle; the clear solution of muriate of ammonia is then decanted off, and the precipitated chalk well-washed and dried. The solution of muriate of ammonia may be again used.

The mode of carrying into effect the second improvement in the manufacture of carbonate of lime is as follows:—100 gallons of a solution of caustic ammonia, of 0·970 spec. grav., are introduced into a vessel similar to that last described, and capable of holding 120 gallons; carbonic acid gas is then forced in, and the solution becomes thereby converted into a solution of bicarbonate of ammonia, which is run into a cistern containing 100 gallons of a solution of caustic ammonia, of the same specific gravity; and a solution of carbonate of ammonia, of 1·050 spec. grav., is thus produced. This is mixed with a solution of muriate of lime, of 1·200 spec. grav., in the proportion of 2 parts of the former to 1 of the latter; decomposition immediately takes place, and the whole becomes a gelatinous mass, which must be stirred until the carbonate of lime assumes the solid form. The mass is then allowed to subside, the clear solution of muriate of ammonia is drawn off, and the carbonate of lime is washed and dried.

IMPROVEMENTS IN THE MANUFACTURE OF SOAP.*

BY GEORGE FERGUSSON WILSON.

This invention consists in manufacturing soap from fatty or oily matters, previously hardened with sulphuric acid.

Ten tons of palm oil, whale oil, or other fatty matter, are put into a wrought-iron vessel, provided with a perforated steam-worm, through which steam is admitted until the matter is heated to 350° F. The fatty matter is then run into a tank, formed of brick, lined with lead, and sunk in the ground; the tank is furnished with a pipe for the introduction of steam, but which does not terminate in a worm, as the sediment from the fat would be

* *Newton's Repertory.*

likely to choke a worm; the cover of the tank is made of wood, lined with sheet lead, and has two man-holes, closed by an oil-joint, about eight inches deep; through the cover a pipe passes, connected with a high shaft, to allow offensive vapours to escape; or the mixed vapours are allowed to escape into a large pipe, wherein they are condensed by a jet of water. 2000 lbs. of concentrated sulphuric acid of 1·8 sp. gr. are poured into the tank; the temperature of the mass being at the same time carefully watched by means of a thermometer, immersed in the mass, and not allowed to exceed 350° F.;—the heat is regulated partly by slackening the speed at which the acid is poured in, and partly by lessoning the heating of the steam admitted into the tank. The admission of steam is continued throughout the operation; but as soon as the whole of the acid has been added, the fire employed for heating the steam is extinguished, and after that the admission of steam is continued for about four hours;—the steam is heated, after it leaves the boiler, by passing through pipes placed over a fire. At the expiration of four hours, the steam is shut off, and a large pump introduced through a pipe in the cover of the tank; then, as soon as the vapours given off will allow the pump to work, the product is pumped into a wooden vessel, lined with lead, and provided with a steam worm; in this vessel the fatty matter is washed, by means of free steam, with about half its bulk of water, for two hours, and is then allowed to rest for twelve hours.

The product thus obtained can be made into soap in the ordinary manner, either alone or combined with softer and cheaper materials; but the patentees prefer to distil the product before applying it to the manufacture of soap;—the distillation may be effected in the manner described in the specification of a patent obtained by George Gwynne and George Fergusson Wilson, November 16, 1843, or in any other suitable manner. A cheap soap may be made by subjecting the distilled product to pressure, and employing the liquid that runs from the press for manufacturing soap, combined with about one-fourth of its weight of the substance known as vegetable wax; or it may be used for making soap in the same manner as tallow oil;—the hard product remaining in the press is applicable to the manufacture of candles.

A black sediment, heavier than water, is formed in the tank in which the sulphuric acid is combined with the fatty matter; this the patentees prefer to distil in a cast-iron still, into which steam is admitted, and to re-distil the product in the manner mentioned with reference to the distillation of the bulk of the acidified fatty matter; and the re-distilled product may be used for making soap.

The proportion of acid above-mentioned may be increased, but with a great loss of fatty matter; and the patentees also state, that half the above proportion will give a good product for soap making.

The patentees do not claim the manufacture of soap from fatty or oily matters previously treated with one-third or one-fourth of their weight of sulphuric acid (or in that proportion); or treated with sulphuric acid by being distilled in combination therewith. But they claim the application, in the manufacture of soap, of fatty and oily matters treated with less than one-fourth of their weight of sulphuric acid, as above-described.

IMPROVEMENTS IN TREATING SEED, AND IN PREPARING MATERIALS USED FOR FERTILIZING LAND, AND FOR AIDING VEGETATION.*

BY AUGUSTUS JULIEN VAN OOST.

The object of the first part of this invention is to apply to the corn or other seed a coating of "sulphuro-azoted principles," which, being absorbed by the young plant, or acting as a ferment, will aid vegetation in a considerable degree; and, for this purpose, the patentee employs a solution of gelatine, albumen, fibrin, or casein, together with certain other matters.

A solution is prepared by dissolving 2½lbs. of gelatine in 6 gallons of water, and 2½lbs. of the meal of malt or wheat is mixed therewith; the corn or other seed, which has been first moistened with a solution of ammoniacal salt or carbonate of potash, at a density of 10°, is then introduced into the solution. When the seeds have become covered with the preparation of gelatine, they will adhere to each other, and to separate them a powder (described below) must be used, which, adhering to the gelatinous grains, will form a coating thereto; and thus, materials to act as a ferment, and others to moderate this action, will be applied to each grain. The powder is prepared in the following manner:—50 lbs. of ashes (such as most closely resemble, chemically, the ashes produced by burning the plant, the seed of which is to be treated), 50 lbs. of carbonate of lime, or lime slaked in the air, 1 lb. of sulphate of iron, 25 lbs. of ground bones, and 25 lbs. of pigeons' dung, are well mixed; the patentee then

* *Newton's Repertory.*

dissolves 1 lb. of gelatine, ½ lb. of sulphate of potash, ½ lb. of carbonate of potash, ½ lb. of nitrate of potash, ½ lb. of ammoniacal salt, ½ lb. of phosphate of soda, and ½ lb. of sulphate of soda, in 6 gallons of water or putrid urine; the two mixtures being combined, a damp powder is produced, which is dried at 150° F., and then used for coating the seeds.

Although only gelatine is mentioned in the above description, the other sulphuro-azoted matters may be used in place thereof, or combined therewith; the object being to add a further quantity of sulphuro-azoted principles to that already possessed by the grain or seed, as casein in peas and beans, fibrin in corn, and albumen in seed.

The patentee does not confine himself to the exact proportions above-mentioned, so long as gelatine, albumen, fibrin, or casein, or matters containing them, are applied, so as to adhere to the grain or seed, together with matters suitable for modifying the fermentation. And he states that the juice of vegetables, blood, milk, cheese, the flesh of animals, and generally all organic liquids, which have a tendency to corrupt, ferment, or putrify, owe this property only to the sulphuro-azoted principles, albumen, fibrin, and casein, which the oxygen of the air converts into ferment, as soon as it meets them in a suitable state.

The second part of this invention consists in the preparation of manure to be applied to land. 4 parts of ashes (similar to the ashes of the crop to be grown), 2 parts of pulverised rubbish of buildings, 2 parts of pulverised coal or coke, 2 parts of lime, slaked in the air, and 1 part of gelatine, are thoroughly mixed; then 1 lb. of sulphate of iron, 1 lb. of sulphate of potash, 1 lb. of nitrate of potash, 1 lb. of common salt, and ½ lb. of phosphate of soda, are dissolved in 6 gallons of water, and added to 100 lbs. of the aforesaid mixture; after which, the whole is dried at 150° F., reduced to powder, and applied to the land. The proportion in which the manure is used varies according to the nature of the soil—the average proportion is 250 lbs. per acre.

The peculiar character of this part of the invention consists in the use of sulphate of iron, of gelatine, and of the sulphuro-azoted matters above-mentioned, and in their close mixture with the alkaline salts and inorganic matters, as above described, so as to favour a slow and regular decomposition.

A NEW MODE OF PREPARING PLASTER OF PARIS IN AN ECONOMICAL MANNER FOR SOLID CONSTRUCTION AND FOR PLASTERING.

BY M. DELASSAUX.

A PAPER on the above subject was lately read at the Institute of British Architects. It appears that English plaster stone is a sulphate of lime, destitute of water, and containing but a small portion of sulphuric acid, being only fit for internal plastering: whereas the stone of the French plaster in the environs of Paris, is composed, in the best proportions, of acid and the bases; and when properly burnt, preserves its acid properties, and becomes fit for exterior decorations—for which purpose it is extensively used in France, as also for the grouting of the stonework and for other purposes, to which, in this country, mortar is applied. Many of the public buildings of Paris are constructed in this manner; and the plaster has been even employed with iron in the construction of the Circus, which is wholly built with these materials—a method uniting incombustibility with extreme facility of execution. The other advantages obtained by using it for building purposes are quickness of setting and of drying, rigidity, strength, and cheapness.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON AMORPHOUS QUININE AS IT EXISTS IN THE SUBSTANCE KNOWN IN COMMERCE AS QUINOIDINE.

BY BARON LIEBIG.

THE following excellent paper appeared in *The Lancet* of the 23rd May:—

In the preparation of sulphate of quinine, after all the crystals which can be obtained are separated, a dark-coloured mother-liquor remains, having an extremely bitter taste. On the addition of an alkaline carbonate, this liquid loses its colour and bitter taste, depositing, at the same time, a yellowish-white, or brownish precipitate, which, after being rinsed with water, and exposed to a gentle heat, agglutinates into a coherent mass, exhibiting the appearance of resin.

From the experiments of Sertuerner,

Thiele, Bucholz, junior, Koch, and other chemists, it has been long known that this resinous substance possesses the properties of a base, that it neutralises acids perfectly; but the salts which are formed by these combinations with acids, have baffled all attempts at crystallisation.

Sertuerner, who was the first chemist to separate this resinous substance from the mother-liquor of sulphate of quinine, considered it to be a distinct and peculiar organic base, existing in yellow and red cinchona barks, associated with quinine and cinchonine. He assigned to this, as he supposed, new substance, the name quinoidine, and greatly extolled its medicinal efficacy, in which he declared it was in all respects equal to quinine. In his journal (*Uber die neuester Furtschritte in der Chemie, Physik und Heilkunde*, Bd. iii., No. 2, page 269,) he terms it "a true fever-destroyer."

Subsequently, this substance, under the term quinoidine, has been employed medicinally in many places, and even introduced into the lists of commercial articles or price currents of many of the druggists of Germany.

In certain mother-liquors of quinine left in the preparation of the sulphate, which were analysed by Henry and Delondre, and also a sample of quinoidine examined by Geiger, these able chemists discovered an amount of quinine and cinchonine, accompanied by a resinous substance which they considered impeded the crystallisation of the sulphates of the two bases, and which in their experiments they failed to separate. The results obtained by these chemists, and the inferences obviously deducible from these results, rendered it indubitable that the medicinal efficacy of quinoidine must vary according to the greater or less proportion of quinine it may happen to contain. Now, there cannot be a doubt but that this uncertainty with respect to the relative amount of quinine in commercial quinoidine, has prevented many physicians from prescribing the latter as a remedy, notwithstanding the testimony borne to its efficacy.

Having occasion, some time since, to pass through Coblentz, I procured from Messrs. Jobst and Co., of that town, a sample of quinoidine, for the purpose of employing it for the preparation of quinoleine—a substance discovered by Gerhardt to result from the transformation of quinine, and to which much scientific interest attaches, in consequence of the recent discovery of Professor A. W. Hofmann, that quinoleine is identical with leucol, a body which is one of the components of the essential oil of tar, prepared from anthracite coal. It then occurred to me, that if the sample of quinoidine which I had procured contained quinine, it must yield a corresponding amount of quinoleine, and that, consequently, a very simple method of testing quinoidine for the amount of quinine it may contain, might be based upon this property of quinine to be transformed into quinoleine.

On subjecting the sample I had obtained (which amounted to several ounces) to distillation with strong potass ley, I confess I was surprised at the large amount of quinoleine produced, which proved the presence of a far larger proportion of quinine than could have been anticipated. This unexpected result induced me to subject quinoidine to a stricter examination; and in order to avoid being misled by accidental circumstances, I procured, beside the Coblentz sample, specimens from Messrs. Hess, Leissler, and Fiedler, of Mayence, and from Messrs. Mettenheimer and Simon, at Frankfort, and also from a druggist at Hamburgh.

These various samples of quinoidine I received partly in irregularly-shaped masses, and partly as square cakes of a darker or lighter brown colour, which, by the warmth of the hand, became soft and flexible, but were readily pulverizable in the cold. The operation of powdering imparted to it an extraordinary degree of elasticity. All these samples were completely insoluble in cold water, but scantily soluble in hot water, imparting to the latter a strongly bitter taste. I may here however observe, in passing, that some commercial specimens which I have since seen are soluble in cold water, arising from a considerable admixture of other substances; differing also, from the same cause, in many of the following properties:—

All the first samples I speak of dissolved in alcohol, in the proportion of one part to two of the menstruum; and from this alcoholic solution, water precipitates copious, yellowish-white, resinous flakes, which cohere into a mass like the original quinoidine. Dilute mineral acids, as well as most of the organic acids, dissolved my samples entirely, and by adding a sufficient amount of the substance, became completely neutralised. From these solutions in acids, ammonia and alkaline carbonates precipitated resinous flakes. On agitating the fluid containing these flakes and the flocculent precipitate, with an equal volume of ether, the precipitate dissolves in the ether, *with the exception of a dark-brown residue.* On evaporating the ether, a resinous mass is obtained, having all the properties of an organic alkaloid.

Its salts are precipitated by tannic acid. Chloride of platinum produces, in its solution in hydrochloric acid, a yellow precipitate. Moreover, it dissolves completely in a solution of sulphate of copper, with the separation of oxide of copper. Now there exists no resin, nor, indeed, any other substance similar to resin, which possesses this peculiar property.

These observations can leave no doubt whatever as to the chemical character of a considerable proportion of the residue to which the term quinoidine has been applied —namely, that it is a true organic base.

On subjecting the purified substance to elementary analysis, the following were the results:—

I. From the quinoidine of Mayence, 0·490 grammes yielded 1·3204 grammes of cabonic acid, and 0·3395 grammes of water.

II. From the quinoidine of Frankfort, 0·618 grammes yielded 1·6575 grammes of carbonic acid, and 0·4250 grammes of water.

III. From the quinoidine of Coblentz, 0·3475 grammes yielded 0·9475 grammes of carbonic acid, and 0·2375 grammes of water.

According to these analyses, this substance contains—

	I.	II.	III.
Carbon..	73·49	73·14	74·33*
Hydrogen	7·69	7·64	7·57

The determination of the nitrogen, by the method of Verrentrapp and Will, yielded the following results:—

0·515 afforded 0·289 of platinum.
0·617 „ 0·401 „

And, consequently, the substance under examination contains, according to the first analysis, 8·04 of nitrogen; according to the second, 9·54 of nitrogen—the medium of the two analyses giving us as its amount of nitrogen, 8·79.

ANALYSES OF THE CHLORIDE OF PLATINUM AND THE BASE FROM QUINOIDINE, (AMORPHOUS QUININE).

I. 0·6663 grammes of the double salt yielded 0·1755 of platinum; 0·8700 grammes of the doubles salt yielded 1·349 carbonic acid, and 0·303 of water.

II. 0·881 grammes of double salt yielded 0·224 of platinum.

III. 1·0668 grammes of double salt yielded 0·2715 of platinum.

From these analyses, therefore, the following are the proportions of carbon, hydrogen, and platinum, which exist in 100 parts of the chloride of platinum, and the substance derived from quinoidine:—

	I.	II.	III.
Carbon..	32·44		
Hydrogen	3·86		
Platinum	26·33	26·32	26·45

Now, if we compare the proportion of carbon, hydrogen, and platinum, existing in the chloride of platinum and this base, derived from quinoidine, with the amount of the same elements present in the corresponding chloride of platinum and quinine; and, further, the amount of carbon, hydrogen, and nitrogen, contained in the substance under examination, with the proportion of the same elements as they exist in quinine; we perceive at once that the two substances have identically the same composition.

Quinine, according to the formula—

$$C^{20}\ H^{12}\ NO^2,$$

contains—

Carbon, 74·33; hydrogen, 7·75; nitrogen, 8·62.

Chloride of platinum and quinine, according to the formula—

$$Cl\ H\ C^{20}\ H^{12}\ NO^2 + Cl\ Pt,$$

contains—

Carbon, 32·38; hydrogen, 3·53; platinum, 26·83.

The inference from these experiments, then, is irresistible: the uncrystalline substance derived from quinoidine bears exactly the same relation to ordinary quinine that uncrystalline sugar (barley-sugar) bears to crystalline (sugar-candy). Both yield the same atomic weight, and identically the same composition; they differ only in form: in one word, one is crystalline, the other *amorphous*.

I deem this to be an important discovery, when we consider the high price of quinine, the possibility of a check to the supply of cinchona bark from the countries producing it, and the amount of the crude quinoidine which has accumulated since the manufacture of sulphate of quinine was commenced. Quinine, indeed, seems to be absolutely indispensable for the treatment of diseases; the progress of civilisation in modern times has depended, far more than has been conceived, upon the discovery of a remedy for the fevers which prevail where tillage is imperfect, and in new and unbroken soils.

This chemical investigation has thrown an interesting light upon the testimonies borne to the efficacy of quinoidine in the treatment of fever, and the highest encomiums have been passed upon it; but the commercial specimens have differed very much in value; while some have consisted nearly

* Carbon = 75, according to Prout and Dumas.

altogether of amorphous quinine, others have contained only a small per centage.

It is necessary that the amorphous quinine should be separated from all admixtures and impurities, and prescribed in its pure state. There can be no doubt but the same substance will produce the same effect on the animal organism, whether exhibited in a crystalline or an amorphous state. The system, as we may say, makes no difference in such a case. As I have already observed, the mystery about quinoidine is completely solved by the discovery, that it usually contains a very large per centage of pure quinine in an amorphous state.

In a commercial point of view, it is certainly a matter of great importance that we should be able to judge by the mere external appearance of a remedy, of its purity; and, consequently, how far we may rely upon its efficacy. This is thought to be the case with the crystalline sulphate of quinine, whilst the non-crystalline form of quinoidine has probably led to a disregard of the evidence for its usefulness, even more than the fact of its being, as usually sold, an admixture of various substances. But with respect to the mere amorphous form, when the quinine is separated from all its adhering impurities, it is in the same case with opium, castor, and many more of the most efficient remedies which we possess, particularly with the extracts of our pharmacopœias. It is necessary to be assured of their purity before we employ them, but their amorphous form does not prevent their use. In many of these cases, indeed, having no direct or ready way of testing them, we rely solely upon the honourable character of the merchant and dealer; but we have a completely satisfactory test for the purity of amorphous quinine. Few medicinal agents afford so ready a means of distinguishing them, and detecting admixtures, as the organic alkaloids: but if these tests are not employed, it is as easy to be deceived in purchasing crystalline sulphate of quinine, as the amorphous.

Amorphous quinine is completely soluble in dilute sulphuric acid, and in alcohol, as I have said above; it is also completely soluble in a solution of sulphate of copper, with separation of oxide of copper. And if its solution in a dilute acid yields, upon precipitation by means of ammonia, exactly the same amount of precipitate as the weight of the substance originally dissolved in the acid, there can be no doubt remaining as to the perfect purity of the sample under examination.

It only remains for me to observe, that no dependence should be placed upon the ordinary quinoidine of commerce. As I have already stated, some samples which I have seen, dissolve incompletely in water, forming a dark-brown muddy fluid; these have been probably produced by simply evaporating the mother-liquors of sulphate of quinine to dryness. They are, therefore, uncertain mixtures of various substances with sulphate of amorphous quinine, with or without excess of acid, so that in purchasing such specimens, the buyer is paying the price of an organic alkaloid for sulphuric acid, &c. The pure amorphous quinine should be separated, and it would then form a most valuable remedial agent; but the prescriber must be assured of its purity, and the test I have given will suffice for this purpose.

A TOPICAL APPLICATION FOR CORNS.*

BY LAROCHE.

℞—Olive oil ..... 30 grammes.
White wax ..... 12 ,,

Liquify them, and add q. s. alkanet; beat up this pommade with

Flour ..... 30 grammes.
Acetic acid ..... 90 ,,
Essence of lavender. 4 ,,

Place the mixture in well stoppered bottles.

We spread this topic on a morsel of linen, place it over the corn, and cover the whole with a piece of adhesive plaster.

ON SULPHURIC ACID AS A REMEDY FOR POISONING BY LEAD.†

BY J. HENRY BENNET, M.D.

In the Foreign Department of the *Lancet* for last year (vol. i., p. 607), there appeared an article by M. Gendrin, the celebrated physician to the Pitié Hospital, Paris, on on the preservation of the health of those who work in lead and its preparations. In this article, it is asserted that sulphuric acid not only preserves the workmen who take it from the diseases which follow the absorption of lead into the system, but that it is also a curative remedy of great energy and efficacy in the treatment of these affections. From its being known to many persons that I was long the pupil and house physician of M. Gendrin, I have been often questioned on the subject, and this has induced me to present the following remarks.

The opportunities afforded by the hospi-

* *Journal de Pharmacie.*

† *Lancet*, April 4.

tals of Paris for the study of the diseases occasioned by the introduction of lead into the human economy are considerable, owing to there being in that city several large manufactories of the oxides and salts of lead; and owing, also, to a great number of cases being continually furnished by various trades in which lead or its preparations is used, such as shot and printing-type founderies, potteries, china and crystal works, house-painting, black-dyeing of horsehair stuffs, glazing of visiting cards, &c. During the last few years, the attention of various French pathologists has been directed to saturnine diseases; and, thanks to the facility for research thus afforded, much has been done to increase our knowledge of their causes, symptoms, and progress. The therapeutics of saturnine affections, however, have not improved so rapidly in their hands as their pathology, which is the more to be regretted, as the truly important discovery of M. Gendrin, with respect to the value of sulphuric acid as a therapeutic agent, has not met with that cordial reception to which it is justly entitled. M. Gendrin's views, were, in fact, received with decided hostility by several of the physicians who, by their researches, have connected their names with these diseases—a circumstance which has tended to retard the general adoption of the remedy that he was endeavoring to introduce into practice.

M. Gendrin was first led to try the administration of sulphuric acid in colica pictorum, by the success which he found to follow the administration of alum. This substance has long been used in the treatment of lead colic, especially, I believe, in Germany; and was tried and much talked of in Paris about twenty years ago. Finding it succeed, M. Gendrin concluded that the active agent was probably the sulphuric acid, and on administering it alone, he found himself correct in his surmise. It was in 1830 that this occurred, and since then he has treated by sulphuric acid alone between four and five and hundred cases of saturnine disease, in all the forms under which that affection is susceptible of manifesting itself, and with nearly invariable success; the only exceptions being, if I am not mistaken, a case or two in which the patient died of cerebral or epileptic phenomena before the treatment was well commenced; and a few cases of incurable paralysis, the result of repeated previous attacks.

During the three years that I was with M. Gendrin, I saw a vast number of cases of lead colic; we had, indeed, nearly always two or three men thus affected in our wards, sent from the carbonate of lead manufactory at Clichy. All of these cases were treated with sulphuric acid, and I do not recollect having seen one in which the disease proved refractory to the treatment adopted—a case or two of confirmed chronic paralysis excepted. The duration of the treatment, as far as I can collect from my notes, was about three days in slight cases, and six or seven in severe ones. The sulphuric acid was given, largely diluted with water (forty-four drops to a pint of water), two or three pints being administered in the twenty-four hours. The amount of pure strong acid taken in that time was, therefore, from one drachm and a half to two drachms. Sometimes the sulphuric lemonade, as it was familiarly called, was vomited as soon as ingested. Still, when this was the case, the patient was made to persevere in its use, and the stomach soon became accustomed to the acid, and retained it. When it was retained, the abdominal pains generally began to diminish after the first, second, or third day, the constipation soon giving way naturally, after they had become less intense. In all these instances, not a grain of any kind of medicine was given besides the sulphuric acid, nor was an enema used, the sulphuric acid being the only medicinal agent resorted to, if we except baths.

At the commencement of the treatment, a sulphur bath was given to the patient, the result of which was, that the sulphur, combining with the particles of lead that were on the skin, formed a black sulphuret. The amount of lead which is thus discovered to encrust, as it were, the skin of those who have worked at preparations of lead, is nearly incredible. I have often seen men go into the sulphur bath quite white, and come out nearly as black as negroes. The lead lying on the skin having been thus made visible to the naked eye, the patients were supplied with a hard brush and half a pound of soft soap, and made to scrub themselves daily in a warm bath, until all the black sulphuret had been brushed off. The sulphur bath was then repeated, the sulphuret of lead brought out, brushed off, and the process renewed, until it no longer rendered visible any trace of lead.

This precaution is indispensable with all who labour under saturnine disease, if we wish to ensure patients against relapse. Whilst at the hospitals of La Pitié and Saint Louis, I have repeatedly had patients under my care with lead colic, who had been discharged as cured from other hospitals a few weeks previously. The sulphur bath, which exhibited a thick coating of lead on the skin, explained at once the cause of the relapse. Indeed, the presence of this coating of lead on the surface of the body is, no doubt, the

cause of the relapses which are mentioned by authors as occurring so often in these diseases. The lead which thus lies on the surface is gradually absorbed, and, at last, poisoning having again taken place, all the symptoms to which it gives rise are manifested. No patient who has suffered, and been treated for lead colic, can be considered safe unless he has gone through the ordeal of a sulphur bath, with a perfectly white skin. One of the great advantages of repeating the sulphur baths during the treatment is, that the patients, whom it is easy to convince of the importance of getting rid of the metallic poison when they see it plainly on their bodies, rub with real good will.

The mode in which the acid acts in neutralising the poisonous effects of the lead is easy to explain. It combines, no doubt, with the lead in the tissues, and forms with it an insoluble sulphate or sulphuret, which is consequently inert, and is gradually eliminated from the economy. This is the interpretation adopted by M. Gendrin, and it appears rational enough.

FRENCH WEIGHTS AND MEASURES.*

The pound is equal to 16 ounces.
The ounce ..... 8 drachms.
The drachm ..... 3 scruples, or 72 grs.
The scruple ..... 24 grains.

DIVISIONS OF THE KILOGRAMME.

The kilogramme is equal to 10 hectogrammes.
The hectogramme ..... 10 decagrammes.
The decagramme ..... 10 grammes.
The gramme ..... 10 decigrammes.
The decigramme ..... 10 centigrammes.
The centigramme ..... 10 milligrammes.

APPROXIMATIVE VALUE OF THE DECIMAL WEIGHTS.

The kilogramme is equal to	2 pounds.
The demi-kilogramme	1 pound.
One hectogramme	3 ounces 1 dr. and a half
Three decagrammes, 2 grammes	1 ounce.
One decagramme	2 drs. 36 grs.
Four grammes	1 drachm.
Two ditto	½ drachm.
One ditto, 3 decigrammes	1 scruple.
One gramme	18 grains.
One decigramme	2 grains.
One demi-decigramme	1 grain.
Two centigrammes	½ grain.
One centigramme	¼ grain.
One milligramme	1-40th grain.

* *Medical Times.*

APPROXIMATIVE VALUE OF THE DECIMAL MEASURES.

	Glasses full.	Pts.	Oz.	Drs.
One litre is equal to	6 or	2	0	5
Five decilitres	3 or	1	0	2½
Two ditto	1 or	0	6	2
One ditto	½ or	0	3	1
Five centilitres	¼ or	0	1	4½
Two ditto	1 liqueur-glassful or	0	0	5
One ditto	1 spoonful	0		2½

VALUE OF THE WEIGHTS OF OTHER COUNTRIES AS COMPARED WITH THE FRENCH POUND.

	Pounds.	Oz.	Drs.	Grs.
Germany	0	13	4	48
Amsterdam	1	0	0	42
Belgium	1	0	0	42
Berne	1	0	0	0
Copenhagen	0	15	3	20½
Florence	0	11	0	56
Genoa	0	10	5	60
Geneva	1	0	0	18
Hamburgh	0	15	2	15½
Lisbon	0	15	7	68
London	0	12	3	12
Madrid	0	15	0	16
Milan	0	9	3	0
Monaco	0	15	2	23
Naples	0	10	7	54
(divided into 12 ounces.)				
Paris	1	0	0	0
(divided into 16 ounces.)				
Rome	0	11	0	50
(divided into 12 ounces.)				
Stockholm	0	13	7	8
Warsaw	1	10	4	24
Venice	0	8	6	0
Vienna	1	2	2	32

At Paris, a scruple is equal to 24 grains; a drachm to 72 grains. Everywhere else a scruple is equal to 20 grains; and a drachm to 60 grains.

EMPLOYMENT OF SULPHATE OF IRON AS A CURE FOR CHRONIC SWEATINGS.*

BY PROFESSOR LIEBIG.

The following is the formula:—

℞—Gray quinquina ..... 30 grms.
Water ..... 300 ,,

Boil for eight or ten minutes, filter, and add to the filtered liquid—

Sulphate of iron ..... 40 centigrms.
Simple syrup ..... 30 grms.

Mix, to form a drink, of which half a coffee cupful is to be taken every two hours.

* *Journal de Pharmacie.*

ADULTERATION OF IODIDE OF POTASSIUM BY MEANS OF THE BROMIDE; THE MEANS OF DETERMINING THE AMOUNT OF THE LATTER IN THE COMPOUND.*

BY M. PERSONNE.

The adulteration of iodide of potassium by the bromide of the same base, being a known fact, we thought it would be useful to publish the following process, by means of which we can not only ascertain the presence of these two products in the compound, but also determine the relative proportions of each.

When we treat a solution of iodide of potassium with sulphate of copper, we know that a protoiodide of copper is immediately precipitated, and that consequently half the iodine of the iodide remains in solution, notwithstanding the excess of sulphate that has been added.

M. Duflos has shown that we can precipitate the whole of the iodine in the solution in the state of protoiodide of copper, if we add an excess of sulphurous acid, which, acting in concert with the iodine, reduces the binoxide of copper to the state of protoxide, by itself passing into the state of sulphuric acid.

As the same reaction does not take place in the case of the chlorides, this method has been applied to the discovery of chloride of potassium in the iodide; it remained to be seen whether it could also be employed for the detection of bromide in the same salt, I have satisfied myself by accurate experiment that it is equally correct as in the last case.

The operation is performed in the following manner:—We dissolve the suspected iodide in a sufficient quantity of cold distilled water, we add an excess of sulphate of copper in solution, we then saturate the mixture with sulphuric acid; as soon as the latter is in excess, the whole of the iodine is precipitated in the state of protoiodide of copper; while the bromide remains undecomposed, we separate the iodide of copper by filtration, and it may be weighed after being washed and dried. The water arising from the washing is to be added to the filtered liquid, we add a fresh quantity of sulphate of copper and sulphurous acid and boil the mixture; the whole of the bromide is then decomposed in its turn, and the bromine precipitated in the state of protobromide of copper, the quantity of which can be determined as in the first instance.

If we should be content with the determination of the presence of bromine in the compound, it is sufficient, after having separated the iodide of copper by filtration, to place the liquid in a tube, pour upon it a little ether and chlorated water, then shake it, and, if left at rest, the ether will rise to the surface, bringing with it the whole of the bromine, which tinges it of a reddish-yellow colour.

This method, by its simplicity and accuracy, is preferable to that which consists in converting the mixture into iodide and bromide of silver, which are afterwards separated by ammonia; for the latter process almost always gives incorrect results.

* *Journal de Pharmacie.*

ANTISPASMODIC SYRUP AND SEDATIVE DRAUGHT.*

BY M. CASE.

℞—Lime-tree flower water	120	grms.
Double orange flower water	15	,,
Fine lump sugar	270	,,
Mix while cold, and add		
Sulphuric ether	25	,,

NEW MODE OF PREPARING ADHESIVE AND STRENGTHENING PLASTERS OF INDIA-RUBBER.

BY WILLIAM H. SHECUT AND HORACE H. DAY, OF NEW YORK.

The articles we employ in the preparation of the said plasters, are those known in commerce as caoutchouc, or India-rubber pine gum (obtained from the southern yellow pine, commonly termed "long leafed" pine), cayenne pepper, balsam of Peru, litharge, and spirits of turpentine.

The proportions are five pounds India-rubber, reduced to fine shreds, steeped in soft water for softening it, then put, with sufficient quantity of spirits of turpentine to cover the India-rubber, in a vessel; the quantity to be increased as the gum soaks it up. When the rubber is sufficiently dissolved, it is pressed through a fine sieve. Four ounces of capsicum amnum, or cayenne pepper, is heated in a quart of spirits of turpentine. A portion of this tincture is ground with a pound of litharge and then mixed with the remnant of the tincture, and to it is added six ounces of the balsam of Peru. Then melt a pound of pinegum, and add spirits of turpentine until it is thin enough to strain, and finally, all the preceding preparations are mixed together.

* *Journal de Pharmacie.*

IV. REVIEWS AND NOTICES OF BOOKS, &c.

LECTURES ON THE URINE, AND ON THE PATHOLOGY DIAGNOSIS, AND TREATMENT OF URINARY DISEASES. By John Aldridge M.D. Dublin: Machin.

The six lectures of which this work consists, appeared, in the first instance, in the pages of the *Dublin Medical Journal*, they are here reprinted in a collected form. A knowledge of the branch of organic chemistry on which they treat is necessarily of vast importance to the professional man; and the subject appears to have been treated with great skill by the author, his observations being evidently founded on considerable experience of the various diseases by which the urine is likely to be affected. The mode of treatment laid down, and the several formulæ by which it is illustrated will also be found of much service to the medical practitioner.

THE THIRTEENTH ANNUAL REPORT OF THE ROYAL CORNWALL POLYTECHNIC SOCIETY, 1845. Falmouth: J. Trathan. London: Simpkin and Marshall.

The publication before us is an evident proof of the wide dissemination of scientific knowledge throughout the land, of the development of "the great scheme of God, the mind of man." The inhabitants of the mining districts of Cornwall, however, have long been noted for their superiority in this respect, over their neighbours in the agricultural counties; but this must necessarily be the case on account of the nature of their employment, which forces the contemplation of scientific facts so frequently upon their notice; and the publication of the present work is a proof of the useful direction this knowledge has taken. During the thirteen years this society has existed, many useful papers have been laid before the public by its contributors, nor is the present number behind its predecessors.

It contains, among others, a detailed account of the progress of the potato disease in Cornwall, by Mr. Jonathan Couch, whose contributions to British Ichthyology are so well known through the medium of Mr. Yarrell's "History of British Fishes." We have also an able paper on Certain Pseudomorphous Crystals of Quartz, by Mr. Robert Were Fox, from which we purpose to make an extract in our next number. A description of the man-engine at the United Mines Gwennap, relates to a humane effort of the projectors to relieve the men employed in the mines from their laborious ascent and descent of the deep shafts, when they commence and leave off their labour. The distribution of honorary and pecuniary rewards for talent and ingenuity of various kinds, in which all classes can participate, and the annual exhibition greatly tends to make the society popular, and popularity is a strong and necessary means towards success.

MISCELLANEA.

ON THE EXTINCT MAMMALS OF AUSTRALIA, WITH ADDITIONAL OBSERVATIONS ON THE GENUS DINORNIS OF NEW ZEALAND.*

BY PROFESSOR OWEN.

In a previous report, Professor Owen had demonstrated the former existence in Australia of two genera of marsupial animals, rivalling in size the rhinoceros and hippopotamus of the old continent. Since the reading of his first report, Prof. Owen had received three molar teeth belonging to the upper jaw of the *Diprotodon*; the crown of each tooth was divided into two principal transverse ridges, like those of the lower jaw, and the enamel presented the wrinkled and punctate surface peculiar to the genus. With these was found a large scalpiform incisor, whose bevelled cutting edge showed that it worked upon a similar tooth in the lower jaw. The *Diprotodon*, therefore, had molars like the kangaroo; but, instead of the two large incisors in the lower jaw being opposed to six smaller in the upper, as in the kangaroo, it had two large incisors above as well as below, agreeing in form and structure, and relative size, with those of the wombat.

* *Mag. Nat. Hist.*

Prof. Owen considered himself justified in concluding that the *Diprotodon* combined the characters of *Phascolomys* with those of *Macropus*, exhibiting both upon a gigantic scale, and constituting one of those links in the chain of being which the course of time has broken and destroyed. Prof. Owen also stated that a large collection of bones of the *Dinornis* had been obtained from a new locality by Mr. Percy Earle. This collection contains four of the species of *Dinornis* already described, including the three most remarkable for gigantic stature. One of these, with a stature nearly equalling the ostrich, presents in all the bones of its leg double the thickness in proportion to their length, and must have been the strongest and most robust bird, in proportion to its size, that ever existed. Of the gigantic species, vertebræ, ribs, and an almost entire sternum, most resembling that of the apteryx, have been obtained. The Rev. Mr. Williams has also transmitted the cranial portion of a skull related in size to the *Dinornis struthoides*, manifesting many peculiarities and a striking resemblance to the same part in the dodo and apteryx.

TREASURE SEEKERS.

We recommend the following particulars to the notice of the modern seekers of hidden treasure—the Joint Stock Company projectors of the present day. The *Journal de Toulouse* state that the excavations making near the church of Saint Sernin have yielded these further results:—The second stratum is composed of a black gravelly earth; and here was found, a few days since, a tomb of white marble and four other tombs;—two being of the white calcareous stone of the Pyrenees, the third of white marble, and the fourth of the Roman bricks formerly used for the roofing of houses and public buildings. The geological composition of the lower stratum, formed, as we have said, of a black and gravelly earth—the ordinary produce of the transport and settlement of waters—has recalled the tradition that a lake formerly occupied the site on which Saint Sernin stands; and the popular imagination, which goes far when it is once aroused, has suddenly remembered, too, that the famous golden treasure of the Temple of Delphi was flung into this very lake by the Tectosagi—and has been valued at the sum of 3,846,000,000 of francs of the present time, to a sous. This is 153,840,000*l.* of our own money! We are particular; because we think a scheme may be formed upon these data, which shall create some diversion for the railways.

DISCOVERY OF A MINERALOGICAL CAVERN.

The improvement of the road from this town to Fort Augustus has led to the discovery of a cavern, near Abriachan, about seven miles from Inverness, partly filled with that peculiar deposition from limestone called alabaster, or more properly, stalactite and stalagmite. The entrance, which is well seen from the road, has the appearance of a door, sloping backwards with the angle of the mountain, which the cave penetrates for about twenty-one feet in a horizontal direction, varying in height from six to ten or twelve feet, and from one to two yards in breadth; the roof in one part has a dome-like form composed of shattered rock, through which water oozes. At the extremity of the cavern there is an opening in the rock running inwards two or three yards, completely encrusted with stalactite, together with pieces depending from the roof; the whole is formed by water containing carbonate of lime, with carbonic acid, trickling through the crevices.

CAPABILITY OF EFFUSED BLOOD FOR ORGANIZATION.*

Whatever doubt may still remain in the minds of some, whether Mr. Hunter maintained the truth in his doctrine that the blood could be organised—that is, that the whole substance of a portion of blood, being at rest either within or without a vessel, may develop itself into tissue and become vascular, and grow and nourish itself, must be satisfied by the observations of Dr. Zwicky on the metamorphoses of the thrombus, or clot of blood which forms in a vessel above a part at which it is tied. For observations, which, like these, stand on the boundary between physiology and pathology, no more space can be given than to state briefly the result; which is, that, to all microscopic appearance, the organisation of the fibrin in an inflammatory condition, and of that in a clot of blood, is in all essential respects the same process, the presence of the blood corpuscles in the latter having no further influence on the process than that of somewhat retarding it. The whole process of the metamorphosis of the fibrin of the blood into fibro-cellular tissue, and of the formation of vessels in it, is satisfactorily traced; and thus the only additional evidence which was needed is supplied for the establishment of another of the long-doubted Hunterian doctrines.

* Paget's Reports in the *British and Foreign Review*.

MEASLES TRANSMITTED BY INOCULATION.

Dr. M. Von Katona, in a very malignant and wide-spread epidemic of measles, in the year 1841, inoculated 1,122 persons with a drop of fluid from a vesicle, or with a drop of the tears of a patient with measles. It failed in seven per cent. of those on whom it was tried; but in all the rest the disease was produced in a very mild form, and not one of them died. At first, a red areola formed round the puncture, but this soon disappeared. On the 7th day fever set in, with the usual characters of measles; on the 9th or 10th, the eruption appeared; on the 14th, desquamation commenced, with decrease of the fever and the eruption; and by the 17th the patients were almost always perfectly well.

ON THE SUBDIVISION OF THE GENUS TEREBRATULA.

BY J. MORRIS.

A paper, of which the following is the substance, was read on the 22nd April, before the Geological Society:—

After describing the subdivisions of this genus established by Lamarck, De Blainville, Von Buch, and Prof. Phillips, and alluding to the researches of Dr. Carpenter on the structure of shells, the author, agreeing with the latter as to the importance of the punctation of the surface in the shells in question, states, that on separating the two general forms which exist among the Terebratulæ, that of plicated and smooth species, it will be found that the majority of the smooth species have a truncated beak and a punctated shell, and, on the other hand, a large number of the plicated species have an acute beak and a non-punctated structure. "Following out this simple observation, in connexion with the other characters before mentioned, we arrive at constant and definite characters for two subdivisions of this genus, entirely dependant on the following general proposition, viz.: that certain positions of the foramen, with regard to the beak, its form and character, and its relation to the deltidial area, always accompany the presence or absence of a punctated structure."

To these two divisions the author applies the terms *Epithyridæ* and *Hypothyridæ*, as suggested by Professor Phillips; and states that, in the Epithyridæ the beak is always more or less obliquely truncate, and the foramen is in the substance of the dorsal valve, while the shells, whether plicated or smooth, have a punctated structure, and are generally longer than wide. This group includes most of the recent species and those of newer geological periods. The Hypothyridæ, on the other hand, have their beaks acute and never truncated; the foramen is below the beak and within the deltidial area; the shells are non-punctated, mostly deeply plicated, generally wider than they are long, and are most of them species met with in the older rocks. The author concluded with some observations on the peculiar characters of certain groups of species.

THE BLOOD-CORPUSCLE CONSIDERED IN ITS DIFFERENT PHASES OF DEVELOPMENT IN THE ANIMAL SERIES.

BY THOS. WHARTON JONES, ESQ., F.R.S.

This paper is divided into three parts; the first relating to the blood-corpuscles of the vertebrata; the second to those of the invertebrata; and the last to a comparison between the two. He first describes the microscopic appearances of these corpuscles in different classes of vertebrate animals, beginning with the skate and the frog, and proceeding to birds and mammifera: first in their early embryonic state, and next in the subsequent periods of their growth. He finds in oviparous vertebrata generally, four principal forms of corpuscles. These he distinguishes as the phases, first of the granule blood-cell, which he describes as a cell filled with granules, disclosing by the solvent action of dilute acetic acid on these granules a vesicular, or as the author terms it, a "cellæform" nucleus. These granule cells appear under two stages of development, namely, the coarsely granulous stage and the finely granulous stage. The second phase is that of the nucleolated blood-cell, oval in shape, containing a vesicular (or "cellæform") nucleus, and red-coloured matter. These cells likewise appear under two stages of development; colourless in the first and coloured in the second, in which last stage it constitutes the red corpuscle. In the early mammiferous embryo, he finds, in addition to the former, a third phase, that of free vesicular nucleus, exhibiting, like the nucleolated cell, the colourless and the coloured stages.

On examining the corpuscles of the lymph of vertebrate animals, the author finds them in all the classes to be identical in structure with their blood-corpuscles, and differing only in the inferior degree of colouration, attending their last stage. In the oviparous classes, he observes that the nucleolated are more numerous than the granule cells, while in the mammifera the latter are pre-

dominant, which is the reverse of the proportion in which they exist in the blood of these animals. He finds that some of the nucleolated cells of the contents of the thoracic duct exhibit a marked degree of colouration, and have an oval shape; thus offering a resemblance with the blood of the early embryonic state.

The blood-corpuscles of all the invertebrate animals in which the author examined them, present the same phases of granule and nucleolated cells as in the higher classes, excepting that in the last stage of the latter phase the colouration is very slight, but the vesicular nucleus is frequently distinctly coloured. As in the higher classes, corpuscles exist in different states of transition from the granular to the nucleolated form of cell. In some of the invertebrata, corpuscles are found which appear to be the nuclei of some of the nucleolated cells become free; and these the author considers to be abortions, rather than examples, of cells having attained their third phase of free cells. Corpuscles are also met with in these animals, in greater or less abundance, belonging to the lowest forms of organic elements, namely, elementary granules.

The comparison which the author institutes between the blood-corpuscles of the vertebrate and invertebrate divisions of the animal kingdom, tends to show that they in all cases pass through similar phases of development, except with respect to the last, or coloured stage of the nucleolated cell, which they do not attain in the lower classes of animals. He finds that the blood-corpuscles of the crab, according to an analysis made by Professor Graham, contain a sensible quantity of iron, perhaps as much as red corpuscles. He considers the corpuscles of the blood of the invertebrata, in as far as relates to the absence of nucleolated cells, as resembling those of the lymph of vertebrate animals.

ON NITRANILINE—A NEW PRODUCT OF DECOMPOSITION OF DINITROBENZOLE.*

BY DRS. MUSPRATT AND HOFMANN.

THE following paper was read before the Chemical Society of London, Mar. 6, 1846:—

The attempt by the authors to prepare a substitution-compound of aniline, in which the elements of nitrous acid should replace a part of the hydrogen of that body, was, after repeated failures, accomplished; not, however, by the direct action of nitric acid on aniline, which gave merely nitrate of aniline when the acid was employed cold—or products of decomposition, as carbazotic acid, when heat was applied. Other means, thought likely to yield the body in question, were also unsuccessful. It was at length obtained by the action of sulphuret of ammonium on dinitrobenzole, a product of the long-continued action of nitric acid of great strength upon nitrobenzide. The dinitrobenzole is dissolved in alcohol, saturated with ammoniacal gas, and treated with sulphuretted hydrogen until the conversion is complete, and sulphur ceases to be deposited. Hydrochloric acid is then added in excess, and the solution filtered and mixed with potash, which throws down the new substance as are sinous mass of a brown colour. It is purified by crystallisation from boiling water or alcohol.

Nitraniline contains C^{12} (H^6NO^4) N. Its properties are as follows:—It crystallises from hot water in long yellow needles, is sparingly soluble in the cold, but is dissolved without difficulty by alcohol and ether. The dilute acids also dissolve it, the solutions being precipitated by potash, in yellow flakes. It is inodorous in the cold, but when heated exhales an aromatic smell. Nitraniline is fusible at 230° F., and distils without decomposition at a temperature above 540° F. When heated in the air, it takes fire and burns with a smoky flame. In very many other respects, the properties of the new substance resemble those of aniline.

The basic powers of nitraniline are exceedingly feeble, and it is utterly destitute of alkaline reaction to the most delicate test-paper. The hydrochlorate, the same salt in combination with bichloride of platinum, the acid oxalate, and some products of decomposition of the base were also described in the paper.

* *Chemical Gazette.*

TO CORRESPONDENTS.

"I. D." (Leamington) can procure Vol. V. of *The Chemist* through any bookseller, or it will be sent direct by our publisher on receipt of a post-office order for 12*s.* 6*d.* We feel obliged by the communication forwarded, and shall be happy to insert practical papers at all times.

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THE CHEMIST.

I. CHEMISTRY.

AN ESSAY ON COFFEE.

BY M. PAYEN.

Payssé, Chenevix, Cadet de Vaux and Cadet de Gaisicourt, have examined the composition of coffee without separating any of the ultimate principles; Runge discovered and Robiquet studied cafein, a crystallisable nitrogenated substance, which sublimes by heat in the form of white and glittering needles. Cafein is identical with thein, discovered afterwards in the leaves of the tea plant. According to the analyses of Messrs. Whöler and Liebig, it contains 0·288 of nitrogen. Robiquet pointed out two fatty substances in coffee, one of which appeared to him to be analogous to the resins, and possessed of a sharp taste; and a sugary substance with a balsamic odour.

M. Rocheleder, a skilful German chemist, examined, in 1844, the fatty substances of coffee, from which he separated, by saponification, palmatic and oleic acid; he demonstrated the fact, that coffee contained no resin, and he indicated the presence of legumine, a nitrogenated substance. The resisting tissue appeared to him to be entirely composed of the ligneous substances I have described.

Notwithstanding the efforts of the philosophers, whose names I have cited, the chemical knowledge of this important production was not complete; they were not even sufficient to answer questions of economy as to the elementary composition of the infusion of coffee and its nutritive properties, either separately or associated, in the usual manner, with sugar and milk.

In fact, the authority of the scientific name of M. Liebig might have induced a belief that this infusion was possessed of no nutritive property, for he said it can only contain a substance possessing a minimum quantity of nitrogen, namely, cafein, which, in its composition, resembles alloxan and taurin.

If I do not deceive myself, the soluble compound most worthy of notice, on account of its proportion, its properties, and the difficulty of extracting it, remained to be discovered in coffee. Its presence was revealed to me by the frequent miscalculations its easy changes introduced into my analyses: the principal change was manifested by the rich green colour, whose condition and cause I studied, and which, from that time, after having long embarrassed me, became a certain guide for the extraction of the substance by which it was occasioned. We may easily comprehend this when we see the crystalline substance in the perisperm of coffee, which, in its natural state, is white, give a deep green colour to 5,000 times its own weight of a watery or alcoholic liquid.

A simple experiment will enable us to judge: I mix a few drops of ammonia with a weak and almost colourless solution of coffee in its normal state. The solution instantly becomes of a yellow colour, which gradually passes to a deep green, bordering on blue; first at the surface exposed to the air, and spreading by degrees to the bottom of the vessel. This remarkable property may, perhaps, find an economical application in the colouring of liqueurs and confectionary, by doing away with the danger of certain colouring matters.

I shall point out in the second part of this essay several other phenomena of colour under the influence of various agents, as well as the principal analytical results relating to this new compound, and the process for the direct extraction of cafein, at least as pure as it was ever obtained, and containing 30 per cent. of nitrogen.

A previous rapid examination, under the microscope, assisted by the method pointed out in the preceding memoirs on vegetable development, give the following results:—

The resisting mass, of a horny appearance, that forms the perisperm or endosperm of the seeds, when deprived of their pericarp, exhibits a tissue of juxtaposed cells with thick sides, excavated with irregular cavities communicating with each other. This explains the possible exhaustion of coffee when

* *Comptes Rendus.*

Its salts are precipitated by tannic acid. Chloride of platinum produces, in its solution in hydrochloric acid, a yellow precipitate. Moreover, it dissolves completely in a solution of sulphate of copper, with the separation of oxide of copper. Now there exists no resin, nor, indeed, any other substance similar to resin, which possesses this peculiar property.

These observations can leave no doubt whatever as to the chemical character of a considerable proportion of the residue to which the term quinoidine has been applied —namely, that it is a true organic base.

On subjecting the purified substance to elementary analysis, the following were the results:—

I. From the quinoidine of Mayence, 0·490 grammes yielded 1·3204 grammes of cabonic acid, and 0·3395 grammes of water.

II. From the quinoidine of Frankfort, 0·618 grammes yielded 1·6575 grammes of carbonic acid, and 0·4250 grammes of water.

III. From the quinoidine of Coblentz, 0·3475 grammes yielded 0·9475 grammes of carbonic acid, and 0·2375 grammes of water.

According to these analyses, this substance contains—

	I.	II.	III.
Carbon..	73·49	73·14	74·33*
Hydrogen	7·69	7·64	7·57

The determination of the nitrogen, by the method of Verrentrapp and Will, yielded the following results:—

0·515 afforded 0·289 of platinum.
0·617 ,, 0·401 ,,

And, consequently, the substance under examination contains, according to the first analysis, 8·04 of nitrogen; according to the second, 9·54 of nitrogen—the medium of the two analyses giving us as its amount of nitrogen, 8·79.

ANALYSES OF THE CHLORIDE OF PLATINUM AND THE BASE FROM QUINOIDINE, (AMORPHOUS QUININE).

I. 0·6663 grammes of the double salt yielded 0·1755 of platinum; 0·8700 grammes of the doubles salt yielded 1·349 carbonic acid, and 0·303 of water.

II. 0·881 grammes of double salt yielded 0·224 of platinum.

III. 1·0668 grammes of double salt yielded 0·2715 of platinum.

From these analyses, therefore, the following are the proportions of carbon, hydrogen, and platinum, which exist in 100 parts of the chloride of platinum, and the substance derived from quinoidine:—

	I.	II.	III.
Carbon..	32·44		
Hydrogen	3·86		
Platinum	26·33	26·32	26·45

Now, if we compare the proportion of carbon, hydrogen, and platinum, existing in the chloride of platinum and this base, derived from quinoidine, with the amount of the same elements present in the corresponding chloride of platinum and quinine; and, further, the amount of carbon, hydrogen, and nitrogen, contained in the substance under examination, with the proportion of the same elements as they exist in quinine; we perceive at once that the two substances have identically the same composition.

Quinine, according to the formula—

$$C^{20}\ H^{12}\ NO^2,$$

contains—

Carbon, 74·33; hydrogen, 7·75; nitrogen, 8·62.

Chloride of platinum and quinine, according to the formula—

$$Cl\ H\ C^{20}\ H^{12}\ NO^2 + Cl\ Pt,$$

contains—

Carbon, 32·38; hydrogen, 3·53; platinum, 26·83.

The inference from these experiments, then, is irresistible: the uncrystalline substance derived from quinoidine bears exactly the same relation to ordinary quinine that uncrystalline sugar (barley-sugar) bears to crystalline (sugar-candy). Both yield the same atomic weight, and identically the same composition; they differ only in form: in one word, one is crystalline, the other *amorphous*.

I deem this to be an important discovery, when we consider the high price of quinine, the possibility of a check to the supply of cinchona bark from the countries producing it, and the amount of the crude quinoidine which has accumulated since the manufacture of sulphate of quinine was commenced. Quinine, indeed, seems to be absolutely indispensable for the treatment of diseases; the progress of civilisation in modern times has depended, far more than has been conceived, upon the discovery of a remedy for the fevers which prevail where tillage is imperfect, and in new and unbroken soils.

This chemical investigation has thrown an interesting light upon the testimonies borne to the efficacy of quinoidine in the treatment of fever, and the highest encomiums have been passed upon it; but the commercial specimens have differed very much in value; while some have consisted nearly

* Carbon = 75, according to Prout and Dumas.

altogether of amorphous quinine, others have contained only a small per centage.

It is necessary that the amorphous quinine should be separated from all admixtures and impurities, and prescribed in its pure state. There can be no doubt but the same substance will produce the same effect on the animal organism, whether exhibited in a crystalline or an amorphous state. The system, as we may say, makes no difference in such a case. As I have already observed, the mystery about quinoidine is completely solved by the discovery, that it usually contains a very large per centage of pure quinine in an amorphous state.

In a commercial point of view, it is certainly a matter of great importance that we should be able to judge by the mere external appearance of a remedy, of its purity; and, consequently, how far we may rely upon its efficacy. This is thought to be the case with the crystalline sulphate of quinine, whilst the non-crystalline form of quinoidine has probably led to a disregard of the evidence for its usefulness, even more than the fact of its being, as usually sold, an admixture of various substances. But with respect to the mere amorphous form, when the quinine is separated from all its adhering impurities, it is in the same case with opium, castor, and many more of the most efficient remedies which we possess, particularly with the extracts of our pharmacopœias. It is necessary to be assured of their purity before we employ them, but their amorphous form does not prevent their use. In many of these cases, indeed, having no direct or ready way of testing them, we rely solely upon the honourable character of the merchant and dealer; but we have a completely satisfactory test for the purity of amorphous quinine. Few medicinal agents afford so ready a means of distinguishing them, and detecting admixtures, as the organic alkaloids: but if these tests are not employed, it is as easy to be deceived in purchasing crystalline sulphate of quinine, as the amorphous.

Amorphous quinine is completely soluble in dilute sulphuric acid, and in alcohol, as I have said above; it is also completely soluble in a solution of sulphate of copper, with separation of oxide of copper. And if its solution in a dilute acid yields, upon precipitation by means of ammonia, exactly the same amount of precipitate as the weight of the substance originally dissolved in the acid, there can be no doubt remaining as to the perfect purity of the sample under examination.

It only remains for me to observe, that no dependence should be placed upon the ordinary quinoidine of commerce. As I have already stated, some samples which I have seen, dissolve incompletely in water, forming a dark-brown muddy fluid; these have been probably produced by simply evaporating the mother-liquors of sulphate of quinine to dryness. They are, therefore, uncertain mixtures of various substances with sulphate of amorphous quinine, with or without excess of acid, so that in purchasing such specimens, the buyer is paying the price of an organic alkaloid for sulphuric acid, &c. The pure amorphous quinine should be separated, and it would then form a most valuable remedial agent; but the prescriber must be assured of its purity, and the test I have given will suffice for this purpose.

A TOPICAL APPLICATION FOR CORNS.*

BY LAROCHE.

℞—Olive oil ..... 30 grammes.
White wax ..... 12 ,,

Liquify them, and add q. s. alkanet; beat up this pommade with

Flour ..... 30 grammes.
Acetic acid ..... 90 ,,
Essence of lavender. 4 ,,

Place the mixture in well stoppered bottles.

We spread this topic on a morsel of linen, place it over the corn, and cover the whole with a piece of adhesive plaster.

ON SULPHURIC ACID AS A REMEDY FOR POISONING BY LEAD.†

BY J. HENRY BENNET, M.D.

In the Foreign Department of the *Lancet* for last year (vol. i., p. 607), there appeared an article by M. Gendrin, the celebrated physician to the Pitié Hospital, Paris, on on the preservation of the health of those who work in lead and its preparations. In this article, it is asserted that sulphuric acid not only preserves the workmen who take it from the diseases which follow the absorption of lead into the system, but that it is also a curative remedy of great energy and efficacy in the treatment of these affections. From its being known to many persons that I was long the pupil and house physician of M. Gendrin, I have been often questioned on the subject, and this has induced me to present the following remarks.

The opportunities afforded by the hospi-

* *Journal de Pharmacie.*
† *Lancet*, April 4.

tals of Paris for the study of the diseases occasioned by the introduction of lead into the human economy are considerable, owing to there being in that city several large manufactories of the oxides and salts of lead; and owing, also, to a great number of cases being continually furnished by various trades in which lead or its preparations is used, such as shot and printing-type founderies, potteries, china and crystal works, house-painting, black-dyeing of horsehair stuffs, glazing of visiting cards, &c. During the last few years, the attention of various French pathologists has been directed to saturnine diseases; and, thanks to the facility for research thus afforded, much has been done to increase our knowledge of their causes, symptoms, and progress. The therapeutics of saturnine affections, however, have not improved so rapidly in their hands as their pathology, which is the more to be regretted, as the truly important discovery of M. Gendrin, with respect to the value of sulphuric acid as a therapeutic agent, has not met with that cordial reception to which it is justly entitled. M. Gendrin's views, were, in fact, received with decided hostility by several of the physicians who, by their researches, have connected their names with these diseases—a circumstance which has tended to retard the general adoption of the remedy that he was endeavoring to introduce into practice.

M. Gendrin was first led to try the administration of sulphuric acid in colica pictorum, by the success which he found to follow the administration of alum. This substance has long been used in the treatment of lead colic, especially, I believe, in Germany; and was tried and much talked of in Paris about twenty years ago. Finding it succeed, M. Gendrin concluded that the active agent was probably the sulphuric acid, and on administering it alone, he found himself correct in his surmise. It was in 1830 that this occurred, and since then he has treated by sulphuric acid alone between four and five and hundred cases of saturnine disease, in all the forms under which that affection is susceptible of manifesting itself, and with nearly invariable success; the only exceptions being, if I am not mistaken, a case or two in which the patient died of cerebral or epileptic phenomena before the treatment was well commenced; and a few cases of incurable paralysis, the result of repeated previous attacks.

During the three years that I was with M. Gendrin, I saw a vast number of cases of lead colic; we had, indeed, nearly always two or three men thus affected in our wards, sent from the carbonate of lead manufactory at Clichy. All of these cases were treated with sulphuric acid, and I do not recollect having seen one in which the disease proved refractory to the treatment adopted—a case or two of confirmed chronic paralysis excepted. The duration of the treatment, as far as I can collect from my notes, was about three days in slight cases, and six or seven in severe ones. The sulphuric acid was given, largely diluted with water (forty-four drops to a pint of water), two or three pints being administered in the twenty-four hours. The amount of pure strong acid taken in that time was, therefore, from one drachm and a half to two drachms. Sometimes the sulphuric lemonade, as it was familiarly called, was vomited as soon as ingested. Still, when this was the case, the patient was made to persevere in its use, and the stomach soon became accustomed to the acid, and retained it. When it was retained, the abdominal pains generally began to diminish after the first, second, or third day, the constipation soon giving way naturally, after they had become less intense. In all these instances, not a grain of any kind of medicine was given besides the sulphuric acid, nor was an enema used, the sulphuric acid being the only medicinal agent resorted to, if we except baths.

At the commencement of the treatment, a sulphur bath was given to the patient, the result of which was, that the sulphur, combining with the particles of lead that were on the skin, formed a black sulphuret. The amount of lead which is thus discovered to encrust, as it were, the skin of those who have worked at preparations of lead, is nearly incredible. I have often seen men go into the sulphur bath quite white, and come out nearly as black as negroes. The lead lying on the skin having been thus made visible to the naked eye, the patients were supplied with a hard brush and half a pound of soft soap, and made to scrub themselves daily in a warm bath, until all the black sulphuret had been brushed off. The sulphur bath was then repeated, the sulphuret of lead brought out, brushed off, and the process renewed, until it no longer rendered visible any trace of lead.

This precaution is indispensable with all who labour under saturnine disease, if we wish to ensure patients against relapse. Whilst at the hospitals of La Pitié and Saint Louis, I have repeatedly had patients under my care with lead colic, who had been discharged as cured from other hospitals a few weeks previously. The sulphur bath, which exhibited a thick coating of lead on the skin, explained at once the cause of the relapse. Indeed, the presence of this coating of lead on the surface of the body is, no doubt, the

cause of the relapses which are mentioned by authors as occurring so often in these diseases. The lead which thus lies on the surface is gradually absorbed, and, at last, poisoning having again taken place, all the symptoms to which it gives rise are manifested. No patient who has suffered, and been treated for lead colic, can be considered safe unless he has gone through the ordeal of a sulphur bath, with a perfectly white skin. One of the great advantages of repeating the sulphur baths during the treatment is, that the patients, whom it is easy to convince of the importance of getting rid of the metallic poison when they see it plainly on their bodies, rub with real good will.

The mode in which the acid acts in neutralising the poisonous effects of the lead is easy to explain. It combines, no doubt, with the lead in the tissues, and forms with it an insoluble sulphate or sulphuret, which is consequently inert, and is gradually eliminated from the economy. This is the interpretation adopted by M. Gendrin, and it appears rational enough.

FRENCH WEIGHTS AND MEASURES.*

The pound is equal to 16 ounces.
The ounce ..... 8 drachms.
The drachm ..... 3 scruples, or 72 grs.
The scruple ..... 24 grains.

DIVISIONS OF THE KILOGRAMME.

The kilogramme is equal to 10 hectogrammes.
The hectogramme ..... 10 decagrammes.
The decagramme ..... 10 grammes.
The gramme ..... 10 decigrammes.
The decigramme ..... 10 centigrammes.
The centigramme ..... 10 milligrammes.

APPROXIMATIVE VALUE OF THE DECIMAL WEIGHTS.

The kilogramme is equal to ... 2 pounds.
The demi-kilogramme ..... 1 pound.
One hectogramme ..... 3 ounces 1 dr. and a half
Three decagrammes, 2 grammes 1 ounce.
One decagramme ..... 2 drs. 36 grs.
Four grammes ..... 1 drachm.
Two ditto ..... ½ drachm.
One ditto, 3 decigrammes ... 1 scruple.
One gramme ..... 18 grains.
One decigramme ..... 2 grains.
One demi-decigramme ..... 1 grain.
Two centigrammes ..... ½ grain.
One centigramme ..... ¼ grain.
One milligramme ..... 1-40th grain.

* *Medical Times.*

APPROXIMATIVE VALUE OF THE DECIMAL MEASURES.

	Glasses full.	Pts.	Oz.	Drs.
One litre is equal to	6 or	2	0	5
Five decilitres	3 or	1	0	2½
Two ditto	1 or	0	6	2
One ditto	½ or	0	3	1
Five centilitres ..	¼ or	0	1	1½
Two ditto	1 liqueur-glassful or	0	0	5
One ditto	1 spoonful	0		2½

VALUE OF THE WEIGHTS OF OTHER COUNTRIES AS COMPARED WITH THE FRENCH POUND.

	Pounds.	Oz.	Drs.	Grs.
Germany	0	13	4	48
Amsterdam	1	0	0	42
Belgium	1	0	0	42
Berne	1	0	0	0
Copenhagen	0	15	3	20½
Florence	0	11	0	56
Genoa	0	10	5	60
Geneva	1	0	0	18
Hamburgh	0	15	2	15½
Lisbon	0	15	7	68
London	0	12	3	12
Madrid	0	15	0	16
Milan	0	9	3	0
Monaco	0	15	2	23
Naples	0	10	7	54
(divided into 12 ounces.)				
Paris	1	0	0	0
(divided into 16 ounces.)				
Rome	0	11	0	50
(divided into 12 ounces.)				
Stockholm	0	13	7	8
Warsaw	1	10	4	24
Venice	0	8	6	0
Vienna	1	2	2	32

At Paris, a scruple is equal to 24 grains; a drachm to 72 grains. Everywhere else a scruple is equal to 20 grains; and a drachm to 60 grains.

EMPLOYMENT OF SULPHATE OF IRON AS A CURE FOR CHRONIC SWEATINGS.*

BY PROFESSOR LIEBIG.

The following is the formula:—

℞—Gray quinquina ..... 30 grms.
Water ..... 300 „

Boil for eight or ten minutes, filter, and add to the filtered liquid—

Sulphate of iron ..... 40 centigrms.
Simple syrup ..... 30 grms.

Mix, to form a drink, of which half a coffee cupful is to be taken every two hours.

* *Journal de Pharmacie.*

ADULTERATION OF IODIDE OF POTASSIUM BY MEANS OF THE BROMIDE; THE MEANS OF DETERMINING THE AMOUNT OF THE LATTER IN THE COMPOUND.*

BY M. PERSONNE.

The adulteration of iodide of potassium by the bromide of the same base, being a known fact, we thought it would be useful to publish the following process, by means of which we can not only ascertain the presence of these two products in the compound, but also determine the relative proportions of each.

When we treat a solution of iodide of potassium with sulphate of copper, we know that a protoiodide of copper is immediately precipitated, and that consequently half the iodine of the iodide remains in solution, notwithstanding the excess of sulphate that has been added.

M. Duflos has shown that we can precipitate the whole of the iodine in the solution in the state of protoiodide of copper, if we add an excess of sulphurous acid, which, acting in concert with the iodine, reduces the binoxide of copper to the state of protoxide, by itself passing into the state of sulphuric acid.

As the same reaction does not take place in the case of the chlorides, this method has been applied to the discovery of chloride of potassium in the iodide; it remained to be seen whether it could also be employed for the detection of bromide in the same salt, I have satisfied myself by accurate experiment that it is equally correct as in the last case.

The operation is performed in the following manner:—We dissolve the suspected iodide in a sufficient quantity of cold distilled water, we add an excess of sulphate of copper in solution, we then saturate the mixture with sulphuric acid; as soon as the latter is in excess, the whole of the iodine is precipitated in the state of protoiodide of copper; while the bromide remains undecomposed, we separate the iodide of copper by filtration, and it may be weighed after being washed and dried. The water arising from the washing is to be added to the filtered liquid, we add a fresh quantity of sulphate of copper and sulphurous acid and boil the mixture; the whole of the bromide is then decomposed in its turn, and the bromine precipitated in the state of protobromide of copper, the quantity of which can be determined as in the first instance.

If we should be content with the determination of the presence of bromine in the compound, it is sufficient, after having separated the iodide of copper by filtration, to place the liquid in a tube, pour upon it a little ether and chlorated water, then shake it, and, if left at rest, the ether will rise to the surface, bringing with it the whole of the bromine, which tinges it of a reddish-yellow colour.

This method, by its simplicity and accuracy, is preferable to that which consists in converting the mixture into iodide and bromide of silver, which are afterwards separated by ammonia; for the latter process almost always gives incorrect results.

* *Journal de Pharmacie.*

ANTISPASMODIC SYRUP AND SEDATIVE DRAUGHT.*

BY M. CASE.

℞—Lime-tree flower water	120	grms.
Double orange flower water	15	,,
Fine lump sugar	270	,,
Mix while cold, and add		
Sulphuric ether	25	,,

NEW MODE OF PREPARING ADHESIVE AND STRENGTHENING PLASTERS OF INDIA-RUBBER.

BY WILLIAM H. SHECUT AND HORACE H. DAY, OF NEW YORK.

The articles we employ in the preparation of the said plasters, are those known in commerce as caoutchouc, or India-rubber pine gum (obtained from the southern yellow pine, commonly termed "long leafed" pine), cayenne pepper, balsam of Peru, litharge, and spirits of turpentine.

The proportions are five pounds India-rubber, reduced to fine shreds, steeped in soft water for softening it, then put, with sufficient quantity of spirits of turpentine to cover the India-rubber, in a vessel; the quantity to be increased as the gum soaks it up. When the rubber is sufficiently dissolved, it is pressed through a fine sieve. Four ounces of capsicum amnum, or cayenne pepper, is heated in a quart of spirits of turpentine. A portion of this tincture is ground with a pound of litharge and then mixed with the remnant of the tincture, and to it is added six ounces of the balsam of Peru. Then melt a pound of pinegum, and add spirits of turpentine until it is thin enough to strain, and finally, all the preceding preparations are mixed together.

* *Journal de Pharmacie.*

IV. REVIEWS AND NOTICES OF BOOKS, &c.

LECTURES ON THE URINE, AND ON THE PATHOLOGY DIAGNOSIS, AND TREATMENT OF URINARY DISEASES. By John Aldridge M.D. Dublin: Machin.

The six lectures of which this work consists, appeared, in the first instance, in the pages of the *Dublin Medical Journal*, they are here reprinted in a collected form. A knowledge of the branch of organic chemistry on which they treat is necessarily of vast importance to the professional man; and the subject appears to have been treated with great skill by the author, his observations being evidently founded on considerable experience of the various diseases by which the urine is likely to be affected. The mode of treatment laid down, and the several formulæ by which it is illustrated will also be found of much service to the medical practitioner.

THE THIRTEENTH ANNUAL REPORT OF THE ROYAL CORNWALL POLYTECHNIC SOCIETY, 1845. Falmouth: J. Trathan. London: Simpkin and Marshall.

The publication before us is an evident proof of the wide dissemination of scientific knowledge throughout the land, of the development of "the great scheme of God, the mind of man." The inhabitants of the mining districts of Cornwall, however, have long been noted for their superiority in this respect, over their neighbours in the agricultural counties; but this must necessarily be the case on account of the nature of their employment, which forces the contemplation of scientific facts so frequently upon their notice; and the publication of the present work is a proof of the useful direction this knowledge has taken. During the thirteen years this society has existed, many useful papers have been laid before the public by its contributors, nor is the present number behind its predecessors.

It contains, among others, a detailed account of the progress of the potato disease in Cornwall, by Mr. Jonathan Couch, whose contributions to British Ichthyology are so well known through the medium of Mr. Yarrell's "History of British Fishes." We have also an able paper on Certain Pseudomorphous Crystals of Quartz, by Mr. Robert Were Fox, from which we purpose to make an extract in our next number. A description of the man-engine at the United Mines Gwennap, relates to a humane effort of the projectors to relieve the men employed in the mines from their laborious ascent and descent of the deep shafts, when they commence and leave off their labour. The distribution of honorary and pecuniary rewards for talent and ingenuity of various kinds, in which all classes can participate, and the annual exhibition greatly tends to make the society popular, and popularity is a strong and necessary means towards success.

MISCELLANEA.

ON THE EXTINCT MAMMALS OF AUSTRALIA, WITH ADDITIONAL OBSERVATIONS ON THE GENUS DINORNIS OF NEW ZEALAND.*

BY PROFESSOR OWEN.

In a previous report, Professor Owen had demonstrated the former existence in Australia of two genera of marsupial animals, rivalling in size the rhinoceros and hippopotamus of the old continent. Since the reading of his first report, Prof. Owen had received three molar teeth belonging to the upper jaw of the *Diprotodon*; the crown of each tooth was divided into two principal transverse ridges, like those of the lower jaw, and the enamel presented the wrinkled and punctate surface peculiar to the genus. With these was found a large scalpiform incisor, whose bevelled cutting edge showed that it worked upon a similar tooth in the lower jaw. The *Diprotodon*, therefore, had molars like the kangaroo; but, instead of the two large incisors in the lower jaw being opposed to six smaller in the upper, as in the kangaroo, it had two large incisors above as well as below, agreeing in form and structure, and relative size, with those of the wombat.

* *Mag. Nat. Hist.*

Prof. Owen considered himself justified in concluding that the *Diprotodon* combined the characters of *Phascolomys* with those of *Macropus*, exhibiting both upon a gigantic scale, and constituting one of those links in the chain of being which the course of time has broken and destroyed. Prof. Owen also stated that a large collection of bones of the *Dinornis* had been obtained from a new locality by Mr. Percy Earle. This collection contains four of the species of *Dinornis* already described, including the three most remarkable for gigantic stature. One of these, with a stature nearly equalling the ostrich, presents in all the bones of its leg double the thickness in proportion to their length, and must have been the strongest and most robust bird, in proportion to its size, that ever existed. Of the gigantic species, vertebræ, ribs, and an almost entire sternum, most resembling that of the apteryx, have been obtained. The Rev. Mr. Williams has also transmitted the cranial portion of a skull related in size to the *Dinornis struthoides*, manifesting many peculiarities and a striking resemblance to the same part in the dodo and apteryx.

TREASURE SEEKERS.

We recommend the following particulars to the notice of the modern seekers of hidden treasure—the Joint Stock Company projectors of the present day. The *Journal de Toulouse* state that the excavations making near the church of Saint Sernin have yielded these further results:—The second stratum is composed of a black gravelly earth; and here was found, a few days since, a tomb of white marble and four other tombs;—two being of the white calcareous stone of the Pyrenees, the third of white marble, and the fourth of the Roman bricks formerly used for the roofing of houses and public buildings. The geological composition of the lower stratum, formed, as we have said, of a black and gravelly earth—the ordinary produce of the transport and settlement of waters—has recalled the tradition that a lake formerly occupied the site on which Saint Sernin stands; and the popular imagination, which goes far when it is once aroused, has suddenly remembered, too, that the famous golden treasure of the Temple of Delphi was flung into this very lake by the Tectosagi—and has been valued at the sum of 3,846,000,000 of francs of the present time, to a sous. This is 153,840,000*l.* of our own money! We are particular; because we think a scheme may be formed upon these data, which shall create some diversion for the railways.

DISCOVERY OF A MINERALOGICAL CAVERN.

The improvement of the road from this town to Fort Augustus has led to the discovery of a cavern, near Abriachan, about seven miles from Inverness, partly filled with that peculiar deposition from limestone called alabaster, or more properly, stalactite and stalagmite. The entrance, which is well seen from the road, has the appearance of a door, sloping backwards with the angle of the mountain, which the cave penetrates for about twenty-one feet in a horizontal direction, varying in height from six to ten or twelve feet, and from one to two yards in breadth; the roof in one part has a dome-like form composed of shattered rock, through which water oozes. At the extremity of the cavern there is an opening in the rock running inwards two or three yards, completely encrusted with stalactite, together with pieces depending from the roof; the whole is formed by water containing carbonate of lime, with carbonic acid, trickling through the crevices.

CAPABILITY OF EFFUSED BLOOD FOR ORGANIZATION.*

Whatever doubt may still remain in the minds of some, whether Mr. Hunter maintained the truth in his doctrine that the blood could be organised—that is, that the whole substance of a portion of blood, being at rest either within or without a vessel, may develop itself into tissue and become vascular, and grow and nourish itself, must be satisfied by the observations of Dr. Zwicky on the metamorphoses of the thrombus, or clot of blood which forms in a vessel above a part at which it is tied. For observations, which, like these, stand on the boundary between physiology and pathology, no more space can be given than to state briefly the result; which is, that, to all microscopic appearance, the organisation of the fibrin in an inflammatory condition, and of that in a clot of blood, is in all essential respects the same process, the presence of the blood corpuscles in the latter having no further influence on the process than that of somewhat retarding it. The whole process of the metamorphosis of the fibrin of the blood into fibro-cellular tissue, and of the formation of vessels in it, is satisfactorily traced; and thus the only additional evidence which was needed is supplied for the establishment of another of the long-doubted Hunterian doctrines.

* Paget's Reports in the *British and Foreign Review*.

MEASLES TRANSMITTED BY INOCULATION.

Dr. M. Von Katona, in a very malignant and wide-spread epidemic of measles, in the year 1841, inoculated 1,122 persons with a drop of fluid from a vesicle, or with a drop of the tears of a patient with measles. It failed in seven per cent. of those on whom it was tried; but in all the rest the disease was produced in a very mild form, and not one of them died. At first, a red areola formed round the puncture, but this soon disappeared. On the 7th day fever set in, with the usual characters of measles; on the 9th or 10th, the eruption appeared; on the 14th, desquamation commenced, with decrease of the fever and the eruption; and by the 17th the patients were almost always perfectly well.

ON THE SUBDIVISION OF THE GENUS TEREBRATULA.

BY J. MORRIS.

A paper, of which the following is the substance, was read on the 22nd April, before the Geological Society:—

After describing the subdivisions of this genus established by Lamarck, De Blainville, Von Buch, and Prof. Phillips, and alluding to the researches of Dr. Carpenter on the structure of shells, the author, agreeing with the latter as to the importance of the punctation of the surface in the shells in question, states, that on separating the two general forms which exist among the Terebratulæ, that of plicated and smooth species, it will be found that the majority of the smooth species have a truncated beak and a punctated shell, and, on the other hand, a large number of the plicated species have an acute beak and a non-punctated structure. "Following out this simple observation, in connexion with the other characters before mentioned, we arrive at constant and definite characters for two subdivisions of this genus, entirely dependant on the following general proposition, viz.: that certain positions of the foramen, with regard to the beak, its form and character, and its relation to the deltidial area, always accompany the presence or absence of a punctated structure."

To these two divisions the author applies the terms *Epithyridæ* and *Hypothyridæ*, as suggested by Professor Phillips; and states that, in the Epithyridæ the beak is always more or less obliquely truncate, and the foramen is in the substance of the dorsal valve, while the shells, whether plicated or smooth, have a punctated structure, and are generally longer than wide. This group includes most of the recent species and those of newer geological periods. The Hypothyridæ, on the other hand, have their beaks acute and never truncated; the foramen is below the beak and within the deltidial area; the shells are non-punctated, mostly deeply plicated, generally wider than they are long, and are most of them species met with in the older rocks. The author concluded with some observations on the peculiar characters of certain groups of species.

THE BLOOD-CORPUSCLE CONSIDERED IN ITS DIFFERENT PHASES OF DEVELOPMENT IN THE ANIMAL SERIES.

BY THOS. WHARTON JONES, ESQ., F.R.S.

This paper is divided into three parts; the first relating to the blood-corpuscles of the vertebrata; the second to those of the invertebrata; and the last to a comparison between the two. He first describes the microscopic appearances of these corpuscles in different classes of vertebrate animals, beginning with the skate and the frog, and proceeding to birds and mammifera: first in their early embryonic state, and next in the subsequent periods of their growth. He finds in oviparous vertebrata generally, four principal forms of corpuscles. These he distinguishes as the phases, first of the granule blood-cell, which he describes as a cell filled with granules, disclosing by the solvent action of dilute acetic acid on these granules a vesicular, or as the author terms it, a "cell-form" nucleus. These granule cells appear under two stages of development, namely, the coarsely granulous stage and the finely granulous stage. The second phase is that of the nucleolated blood-cell, oval in shape, containing a vesicular (or "cell-form") nucleus, and red-coloured matter. These cells likewise appear under two stages of development; colourless in the first and coloured in the second, in which last stage it constitutes the red corpuscle. In the early mammiferous embryo, he finds, in addition to the former, a third phase, that of free vesicular nucleus, exhibiting, like the nucleolated cell, the colourless and the coloured stages.

On examining the corpuscles of the lymph of vertebrate animals, the author finds them in all the classes to be identical in structure with their blood-corpuscles, and differing only in the inferior degree of colouration, attending their last stage. In the oviparous classes, he observes that the nucleolated are more numerous than the granule cells, while in the mammifera the latter are pre-

neal, which, when published, will add to his already well-earned reputation as a chemist, and it has also furnished him with a new material available for the improvement of his beautiful and interesting art.

It could not fail to be a subject of remark amongst the students, that the chemist is obliged to have recourse to Bohemian glass for his combustion tubes. One of our friends remarked, that he could induce English makers to fabricate such glass if they knew the exact proportion of its ingredients. Upon this hint Mr. Rowney undertook the task of analysing some specimens of Bohemian glass. Mr. Rowney's accuracy imparts value to the results he has obtained, and it seems very likely that from this point will emanate such improvements in the manufacture of glass as to preclude the necessity of importing it from Bohemia.

Gentlemen, these are trifles—this college is but in its embryo state, it has not even reached infancy; but it is difficult to repress our enthusiasm when we recollect what the science of chemistry has done and is now doing, and contemplate the boundless unexplored regions of Nature inviting our industry, and offering us its sure reward.

Look only at the present uses of gas. Our esteemed friend Mr. Lowe tells us that 1000 tons of coal are daily decomposed for the production of gas in the metropolis; that the iron pipes in London alone measure several hundred miles—the extent of the smaller being almost incalculable; that gasometers are now made as large as a house, and that every town and almost village has its gas-works. Consider the trades created, the myriads of men employed in working the mechanism of this vast chemical process—and recollect that it is only in our own time that this branch of industry has been created. To chemistry, too, we are especially indebted for the present cheapness of this beautiful and indispensable light. The applications found for the other products of the decomposition of coal have enabled the manufacturers to reduce its price; it has become one of the most useful instruments of the laboratory, and it will now be employed, we trust, as a means of effecting further discoveries. Will any one affirm that it is impossible to obtain from coal a solid, dry, portable hydrocarbon, capable of being made a substitute for wax and tallow in the fabrication of candles, and so cheap as to supersede animal fat in lighting the humblest cottages?

The point, however, to which I wish to direct your special attention, in reference to our anticipations of advancing the science, is organic chemistry. The apparatus for organic combustion, the great invention of professor Liebig, is already almost daily in use in our laboratory. By its means, as you know, the analysis of matter belonging to the animal and vegetable kingdoms—the produce, in some form or other, of the vital force—is effected with greater ease and equal precision with the analysis of a soil or a mineral. The rapidity with which discoveries are being made, and the immense extent of the science, render it almost impossible, except for the professed chemist, to follow and to appreciate its importance. Every now and then, however, some fact is made known, having an immediate application to practical purposes, and indicating how vast a field of inquiry exists in organic nature. Within the last few days, Professor Liebig has announced to us that a residue left in the manufacture of sulphate of quinine is the pure alkaloid itself, merely obscured by its form. The discovery of quinine by Pelletier, in 1820, revolutionised pharmacy. The active principles of the most nauseous drugs can now be isolated from the accompaniments of woody fibre and other inert matters, and exhibited in a concentrated form. This is a blessing which only those who have had to swallow bark in substance can fully understand. During the twenty-six years in which sulphate of quinine has been manufactured, a considerable portion, every year, of the pure alkaloid has been laid aside, and consequently a considerable amount has accumulated. Professor Liebig's discovery will not only bring this into use, but it will enable the practitioner of medicine to prescribe the pure alkaloid, and to combine it at pleasure with vegetable or other acids, and thus to obviate the objections which are found in practice to lie against the sulphate of quinine, placing at command quinine and a variety of its salts at a price which will not preclude the poorest from its benefit.

A great proportion of the vegetable kingdom still requires to be chemically investigated; of the materials which constitute the animal body, every one, without exception, awaits a new analysis and investigation. Not many months since, Professor Redtenbacher, of Prague, found that taurine, a constituent of bile, which acts a most important part in the animal economy, contains sulphur to the extent of 26 per cent. This element had been previously overlooked, in consequence of what must be considered a defect in the method of analysis by combustion; in that process the oxygen of the analysed body being estimated by the amount of loss, the equivalent of sulphur being precisely double that of oxygen, its presence did not disturb the calculation of the results. Professor

Gregory has remarked, that this observation of Redtenbacher will probably turn out, in its consequences, one of the most important yet made in animal chemistry; and it cannot be doubted, that although our views must be changed in many points, in consequence of it, our knowledge will be extended and rendered more precise and more capable of direct application to physiology and pathology. Already Professor Liebig has found reason to believe that Mulder's protein and oxides of protein exist only in imagination, as sulphur remains combined with the other elements after fibrin and albumen are subjected to Mulder's processes. To extend this inquiry into all the materials of the animal tissues, requires many skilful hands and much labour.

The principle upon which organic investigations are now pursued, is worthy of your serious attention; it is, to subject a substance to the action of heat, of oxidising and reducing agents, and generally to every influence capable of changing or modifying its composition, to analyse the resulting compounds, to study their mutual relations, and thus to ascertain the true nature of the original matter. This principle was first adopted by Chevreul; its application by Dumas and Boullay to the compound ethers, Professor Liebig says, gave the first impulse to the extraordinary development which chemistry has since then attained. It has created, in fact, a new branch of the science, which it would be of great importance to distinguish by a distinct designation. We are familiar with the distinctions of analytical and synthetical chemistry. Analysis is the separation of a chemical compound into its component parts. Synthesis is the putting together the elements of compounds, and combining them into a chemical union. The formation of water, and of nitric acid, by directly combining their elements, as effected by Mr. Cavendish, are examples of synthesis. Very little has been done in this direction, beyond a few instances illustrative of the safety of depending upon analytical results, in certain cases, as philosophic facts. The only example I recollect of synthetic chemistry applicable to practical purposes is, however, a most brilliant one, made by Gmelin—namely, the formation of artificial ultra-marine, by mixing silica, alumina, soda, and sulphur, colourless bodies, to produce that beautiful blue pigment. There is no reason to believe that it is by way of synthesis that Nature produces the many complex substances, termed organic matter. The affinities of inorganic bodies are employed to group together the proper elements, and in the process of constructing the materials required in vegetable and animal organisms, intermediate compounds are formed, which, not being needed in a separate state, are again combined, and ultimately gave rise to the substances which are the designed results of the process. Proceeding in the path indicated by Chevreul, these internal forms of organic bodies are detached recombined, and undergo a variety of metamorphoses, by which the true constitution of the first is revealed, and new complex bodies created, as it were, as truly organic as any of those produced by the vital force. The theory of compound radicals is the general expression of the fact, that very simple forms, consisting of a few equivalents of two or three elements, may be assumed as the basis or rudimental centres of all the varieties of compounds constructed in living organisms. By breaking up the internal structure of these compounds, or by bringing to bear upon them other affinities, that is, by employing certain media in imitation of the way pursued by Nature, many natural productions can be produced artificially, and a great number can be artificially made, exactly analogous to the acids, neutral bodies, and alkaloids found in plants. Of the former kind, that is, of natural productions produced artificially, several have become of commercial importance: the manufacture of sugar from starch, by the mediation of sulphuric acid; of British gum, also from starch, which has materially affected the commerce of Senegal and the Gambia; and that of valerianic acid, are well-known examples. The process for effecting the first of these transformations will illustrate the action of media. Sugar and starch have the same composition, except that the former contains the elements of two atoms of water more than the latter. To add the water to the starch directly, so as to convert it into sugar, is at present beyond our power. But we know that the vital force, aided by heat, converts starch into sugar. This is the *rationale* of the process of malting. And a method has been known for some time, of effecting the same purpose; that is, of adding the elements of two atoms of water to the elements of starch, and thereby converting it into sugar. This is done by the long-continued boiling of starch in water acidulated with sulphuric acid. The acid acts as a medium to effect the assumption of the water by the starch, and to transform it into sugar, the acid itself remaining unchanged. The same transformation may be effected on linen rags, and any form of ligneous fibre, thus converting them into sugar. Other natural substances which have been produced artificially possess only scientific interest, as urea, formic acid, butyric acid, &c. But it by no means follows that

these are of no practical use. The formation of butyric acid from starch, threw an important light on the sources of animal fat. Natural urea is a curious and highly interesting substance. The restoration of nitrogenous matter which has served its purposes in the animal economy, to the atmosphere, whence it had been derived by vegetable organisms, requires it to be brought into the same form it had originally, in order to its diffusion through the whole mass of air around our planet—namely, into ammonia. But ammonia would injure the animal tissues. The contrivance by which this difficulty has been evaded, excited the admiration of M. Dumas. "Nature, ever provident," says he, "has caused the animal to secrete urea. Urea is a neutral and inert substance, which can pass through the delicate structure of the kidneys, ureters, and bladder, without irritating or inflaming them. By the addition of two atoms of water, it becomes converted into the carbonate of ammonia. In this form it travels from the earth to the atmosphere, from the atmosphere to the earth in rain and dew, and is thence again served upon, and elaborated by, plants, into the forms adapted for animal nourishment."

The manner in which Nature employs the affinities of inorganic bodies as media for the production of organic compounds, is in some cases understood. Thus, for instance, the potass taken up from the soil by plants has a great affinity for carbonic acid, and by virtue of that affinity fixes it from its gaseous state in the atmosphere. In the juices of the plants it meets with water in a nascent state, as it is separated from its combinations in the organism; this water, or rather its elements, combining with the carbonating potass, converts it into oxalate of potass, or by a further accession of hydrogen; into citric, malic, tartaric, and other acids; sugar, gum, starch, &c., oxygen being set free. Thus the affinity of potass for carbonic acid, &c., is the force which primarily originates the changes essential to these combinations. In like manner, but by processes not at present understood, phosphorus and sulphur, in all probability, mediate the production of materials for building up animal bodies, albumen, fibrin, &c.

Of the latter kind—that is, artificial organic compounds—several basic bodies or alkaloids have been formed by Laurent, Hofmann, and others, and a very interesting one from the oil of bran, by Professor Fownes, termed by him furfurine. These alkaloids combine with acids, and form series of crystalline salts, as distinct and well-defined as those of the natural organic alkaloids.

The Great Author of Nature seems to have provided laws regulating the affinities of the elements for the creation by our instrumentality of organic bodies, for which no use is found in nature. It is necessary, however, to be cautious in the latter assertion, because it has happened, in at least three or four instances, that such artificial compounds, first formed in the laboratory, have been afterwards discovered to exist in plants or animals.

In the course of the investigation of M. De la Rue, already alluded to, that gentleman discovered a new crystalline substance existing in cochineal, to the extent of about one-third per cent., which appears to be identical with a substance lately described by Liebig, and formed by him by acting on casein with caustic potass. Salicylic acid, and oxide of methyle, first produced by the decomposition of other organic substances, were afterwards found to coexist in the oil obtained by distilling the flowers of the gualtheria procumbens; and very recently, Professor Redtenbacher, by acting upon oleic acid with nitric acid, and submitting the result to distillation, obtained no less than nine acids in the distillate: one of these is a new acid; but, very curiously, it was discovered at the same time in his own laboratory by a student, in the plant called pelargonium roseum, from which, therefore, he has named the acid, pelargonic acid.

It is impossible, in contemplating these results, to avoid entertaining the belief that chemists are upon a track which will ultimately lead to the production, by artificial processes, of the natural alkaloids, morphine, strychnine, quinine, or such vegetable bodies as indigo, santaline, &c., and to the elucidation of the *modus operandi* of the vital forces in transforming the materials presented to the organs of nutrition of plants and animals.

As I have already observed, an especial designation seems demanded for this branch of chemistry, which is neither analytical nor synthetical. I will therefore propose, in the absence of a better term, to denominate the aggregate of the processes by the term *genesis*, and the subject, *genetical*, or *constructive* chemistry.

This branch of the science is occuping the attention of very many students on the Continent, and is undergoing a rapid development. From the masses of figures and calculations, now accumulating, representing analyses, we may anticipate many practical results, of vast importance, to emerge. I ought not to quit this subject, without alluding to the improvements in candle-making, resulting from Chevreul's labours.

For my own part, I entertain the most sanguine hopes that the diseases most fatal to mankind will be elucidated, and, perhaps, wholly prevented, by pursuing this path of chemical inquiry.

Whilst the science of organic chemistry was advancing on the Continent like a torrent, was this country to be permitted to remain the only one in Europe where the necessary qualification could not be obtained to enable men to assist in this great work? The example of Hesse Darmstadt, in founding and supporting a school at the bidding of Liebig, who has given his country new importance in Europe, has been followed by France, Prussia, Belgium, and even Russia and Austria, and nearly all the smaller German states. Is the accomplished chemist less likely to find profitable employment in the manufactures, arts, and professions of Great Britain, than in those countries? Much as we have to boast of in the way of popular lectures, it might occur to many to suspect the soundness of the knowledge thus obtained if the patent list were examined, and the extraordinary mistakes made, to the serious pecuniary loss of many persons, for want of just scientific notions, considered. I may mention, as an illustration of this remark, the credit given by the public, and, I might add, by some distinguished individuals, to the profession, made not long since, that a fuel had been discovered which would burn and supply heat without leaving the ordinary products of combustion—that no carbonic acid was given to the atmosphere in burning this material. The belief entertained in this ridiculous fiction was sincere enough, as it cost the loss of several lives. Assuredly, the spread of chemists, taught after the manner we have adopted, will supply the public with better instruction.

It is a startling, but neverthless certain fact, that in many of our manufactures, depending, wholly or in part, upon chemical principles, this country is fast falling behind those of the Continent. If the instances in which this is most evident may appear insignificant in comparison with the vast creations of our machinery, it should be remembered how easy a downward progress becomes. "A respect for every department of Nature," says Baron Humboldt, "is especially necessary in the present times, when the material wealth and increasing welfare of nations is so closely connected with the diligent use of natural productions and natural forces. The most superficial glance at the present condition of Europe assures us that any relaxation of effort would be followed by gradual diminution and ultimate annihilation of national prosperity. Nothing but energetic progress in chemistry, and other branches of natural science, will save any state from the evils of a decline. Man can make no use of Nature, can appropriate none of her powers, if he be not conversant with her laws, and the relations of number and measure existing amid her processes. Those nations which relax now in manufacturing activity, in the practical application of technical chemistry, must inevitably fall from any prosperity they may have attained; more especially as neighbouring states, instinct with powers of youthful renovation, in which science and practice co-operate, enter upon the struggle, and press forward in the race."

It is wholly inconceivable, that the enlightened statesmen who guide the energies of this country, will, when once their attention is aroused to those truths, withhold their aid in establishing this college. Its special object is too great to be merged into courses of general education, or to be entrusted to individual exertion. The association and co-operation of but a few persons representing each science and art based upon chemistry, would, however, amply suffice to effect its purposes. Perhaps it is better to call forth voluntary efforts, than to institute schools of chemistry by authority, and to clog them with official restrictions.

Gentlemen, it only remains for me to say what grateful thanks are due from all persons interested in science and the arts, but especially from the gentlemen who enjoy the privilege of our course of instruction, to our Royal President, our noble Vice-presidents, and to the Council, for their generous assistance in founding this college. This they have afforded, under the conviction, that this institution is calculated to confer great and enduring benefits on all classes of their fellow-countrymen, and on all mankind; and that—although not obviously and conspicuously—yet, to the enlightened mind, the highest exercise of benevolence is to promote the extension of our knowledge and of our power over Nature.

To one gentleman, however, we owe an especial debt of gratitude, for his constant personal exertions, the devotion of his valuable time, and the unwearied employment of his influence, with the most noble and enlarged views, to promote the establishment of this college. I should be deprived of the greatest pleasure I derive from my own efforts in its behalf, if I could not publicly acknowledge that our success—which, I trust, is now unquestionable—will be mainly attributable to Sir James Clark.

ON OUR PRESENT KNOWLEDGE OF THE ACTION OF ANIMAL CHARCOAL ON ORGANIC AND INORGANIC SUBSTANCES.*

BY M. F. E. CALVERT.

(*Read before la Societé d'Encouragement, April* 1, 1846.)

In consequence of the importance animal charcoal daily acquires in arts and manufactures, I imagined it would not be uninteresting to the society to read a summary of the works on this subject that have appeared, latterly, in England, and giving, in the first instance, a short notice of those that have been previously published.

We are are aware, as M. Chevalier reminds us, in a memoir he laid before the Academy of Sciences, in 1844, that we are indebted to Kelbs for the discovery of the bleaching property of animal charcoal (*Journal de Physique*, 1793), but it is the excellent experiments of Messrs. Payen, Bussy, and Desfosses that have given us an exact knowledge of the action of animal charcoal. It is M. Payen, in particular, who first directed the attention of chemists to the absorbing property of charcoal, by showing that this substance removes lime from water, and the same base from its own salts. Since then M. Lassaigne discovered that charcoal absorbs every trace of iodine from the liquids that held it in solution.

Mr. Graham discovered that charcoal has the property of completely separating a very large number of basic metallic salts, whether dissolved in water or with ammonia added to them, but that neutral salts and arsenious acid were not separated.

Finally, M. Chevalier, in an interesting account of the action of either vegetable or animal charcoal upon the soluble salts of lead, that is to say, the nitrates and acetates, has shown that charcoal separates the oxide of lead from these salts, leaving the acid free. The author notices the inconvenience that exists in removing the colour by means of charcoal from the liquids obtained in cases of poisoning, as many writers on poisons recommend: the new facts contained in this memoir corroborate and support the idea of M. Chevalier.

The new experiments we are about to describe are due to the inquiries of Messrs. Warrington, Wappen, and Gorrod, who have examined exclusively the action of purified animal charcoal on organic and in organic substances; by operating with this charcoal they have been able to explain certain anomalies that have been observed, as well to as establish a great number of new facts.

Mr. Warrington observed, that if we employ purified animal charcoal, its action on certain neutral salts is different from what has been laid down by Mr. Graham, that is to say, on the sulphates of lime and magnesia, and the chloride of barium.

M. Wappen has confirmed this action of charcoal by operating on the following salts, among which we find other neutral salts:—

Sulphate of copper.
,, zinc.
,, protoxide of iron.
,, protoxide of chrome.
Bichloride of mercury.
Acetate of protoxide of iron.
Neutral acetate of lead.
Nitrate of nickel.
,, coblat.
,, silver.
,, protochloride of mercury.
,, bichloride of mercury.

In general it requires 30 parts of purified charcoal for 1 part of the salt held in solution; but the author directs attention to the fact that he found it impossible to remove every trace of some of the salts, whatever the excess of charcoal he employed. Thus, the protoxide of iron is decomposed into an insoluble subsalt, and a soluble acid, which remains in the solution. The saline compounds this reaction produces are completely precipitated by animal charcoal, and, consequently, the acid salts ought to be placed in the same category.

Not only are the metallic oxides precipitated from their solutions by the charcoal, but also several metallic acids, such as the antimonic and plumbic acids. The arseniates and the arsenites are an exception, as well as several salts.

Chromate of potash and chromic acid are not only reduced by charcoal, but the chromate passes into the state of a carbonate. Finally, a solution of iodiretted iodide of of potassium loses its colour by the action of purified animal charcoal.

M. Wappen refutes M. Mulder's observation, which tends to show that charcoal reduces oxide of lead to a metallic state when it forms part of a neutral acetate.

The action of charcoal on organic matter presents some remarkable facts: for instance, Mr. Warrington has shown that, when cold, charcoal only separates particular bitter principles from their solution, but has no action on others. Thus he has perceived that the bitter taste of beer has disappeared when rapidly filtered through charcoal, while the extracts of quinquina, opium, and nux vomica, as well as the salts formed by these substances

* *Journal de Chimie.*

lose some of their bitterness. M. Warrington observes, with reason, that we may take advantage of this difference in the action of purified charcoal, to discover whether either of these substances has been added to the beer, as often occurs in England. To prove this fact, we must be careful, as the author observes, not to heat the liquids along with the charcoal, for he found, that with the assistance of heat, charcoal has the property, when in the proportion of 50 to 1 of the substance, completely to remove, not only the above-mentioned bitter principles, but also every other submitted to examination. The manufacture of quinine being at present a branch of commerce, Mr. Warrington wished to ascertain the absorbing power of charcoal in the case of this compound: to succeed in this, he dissolved, in 2 ounces of water, 0·1 of bisulphate of quinine, and he added charcoal to the warm liquid until it was no longer bitter—it was necessary to employ 6 decigrammes of charcoal.

These results, so full of interest on account of their importance, had been already suspected by Doctor Kolpff; but, as we see, Mr. Warrington has generalised and defined the action of animal charcoal on bitter principles; and these experiments acquire value by the confirmation they have received in M. Weppen's work, of which I will content myself with giving a summary.

BITTER PRINCIPLES.

Quantity of Substance.	Name.	Quan. of Charcoal.
10 grains dissolved in 50 grams. water.	Colocynth	10
	Columbo root	30
	Gentian root	20
	Quassia	30
	Cascarilla bark	30
2grs. dissolved in 60 grammes water.	Menyanthea trifolia	30
	Aloes	40

RESINOUS PRINCIPLES.

1 dram of the subst. dilated with its own vol. of water.	Guiacum resin	13
	Jalap resin	2

until it is no longer precipitated by water.

ASTRINGENT PRINCIPLES.

1 grain of extract dissolved in 60 grammes water.	Gall nuts	20
	Pure tannin	20
	Rhatany root	20
	Cinchonia bark	20

until no longer tinged with red by the salts of iron.

To conclude, I shall terminate this summary by giving M. Gorrod's conclusions on the properties possessed by animal charcoal, when perfectly pure, of acting as an antidote against certain poisons.

1. Charcoal used in sufficient quantity would not only have the power of removing vegetable and animal principles from water, but also of separating them from a solution analogous to the gastric juice, and be kept at the temperature of the stomach.

2. That charcoal would also form insoluble compounds with arsenious acid, and other metallic salts; hence the author considers that charcoal is an excellent antidote against the poisonous effects of arsenious acid; he even asserts that charcoal acts as powerfully against this poison as the hydrate of peroxide of iron.

3. That the insoluble compounds of animal charcoal and poison, having no action on the animal economy, we may employ this remedy with advantage in cases in which the poison has not been as yet absorbed by the organism.

4. That this antidote is peculiarly applicable in the case of substances whose active principles act in small dozes, such as belladonna, stramonium, nux vomica, aconite, and in the last place opium.

5. That we may administer an unlimited quantity of the antidote, which has no deleterious action.

6. That the quantity administered should vary according to the poison; thus 15 grains of charcoal are sufficient for 20 grains of nux vomica, and the same quantity are necessary for 1 grain of strychnine. It is, however, always an advantage to employ an excess of charcoal for fear an excess of poison should remain and take effect.

7. Finally, that it is of the greatest importance to employ animal charcoal perfectly free from calcareous salts; for the ordinary animal charcoal, according to M. Gorrod, has no action. This last fact explains the reason the author obtained an absorption of arsenious acid by the charcoal, while other observers have published a statement the reverse of this.

ON THE ACTION OF BICHLORIDE OF PHOSPHORUS ON ORGANIC SUBSTANCES.*

BY M. AUG. CAHOURS.

In a paper I had the honour of communicating to the Academy a few months since, as to the determination of the density of the vapour of bichloride of phosphorus at different temperatures, I proved that a molecule of this body furnished 8 volumes of vapour,

* *Comptes Rendus.*

an anomaly that will disappear by considering it, as I propose, as the result of the union of two equal volumes of chlorine, and uncondensed protochloride of phosphorus. Experiment, in fact, shows, that when two gases enter into combination in equal volumes, there is, in general, no condensation; while we always observe one to a greater or less extent when two gases are combined in unequal volumes.

Thus, the bichloride of phosphorus $PhCl^5$ is decomposed by sulphuric acid and watery vapour, giving birth to two substances.

$$Ph\ Cl^3\ S^2 \text{ and } Ph\ Cl^3\ O^2,$$

discovered by Messrs. Serullas and Vurtz, which only differ from the primitive body by the substitution of 2 molecules of sulphur or oxygen for 2 molecules of chlorine. But O^2 and S^2 only represent two volumes; while Cl^2 represents 4. It therefore follows, according to the hypothesis I previously laid down on the constitution of bichloride of phosphorus, that the last two combinations ought not to represent the same grouping as the first. Their molecule can no longer yield 8 volumes of vapour. A condensation must have taken place, and this is confirmed by experiment. In fact, I obtained the number 5·298 for chloroxide of phosphorus, and 5·879 for the chlorosulphuret. Admitting that the molecule of this body furnished 4 volumes of vapour, we should have 5·317 for the first, and 5·875 for the second, numbers that are almost the same as those I obtained in a direct manner.

Resting on the remarkable action of hydrosulphuric acid and the vapour of water on bichloride of phosphorus, I was induced to ascertain how this body would comport itself with different hydrogenated substances, and particularly with organic bodies. This study afforded me very curious results, which I shall content myself at present with alluding to, intending to give the numerical particulars in a paper on which I am now engaged. At present I shall confine myself to the publication of a short note.

Pure and dry hydrogen has no action on bichloride of phosphorus, even at the temperature at which the latter is reduced to a state of vapour.

Benzine $C^{12}H^6$, and retinnaphate $C^{14}H^8$, are also not attacked by bichloride of phosphorus. It may be distilled over this body without producing any action. It is not the same in the case of hydrate of phenyle $C^{12}H^6O^2$ and with anisol $C^{14}H^8O^2$, which only differ from the two preceding substances by two additional atoms of oxygen: these bodies are energetically attacked, producing new compounds.

The different carburets of hydrogen I have examined behave in the same manner as benzine, they are inert in all oxigenated bodies, on the contrary, are acted on with great violence.

We know that alcohol and its congeners, spirit of wood, oil of potato, and ethal, treated with bichloride of phosphorus, produce chlorides of ethal, methyle, cetyle, and amyle—

Chloride of methyle.	Chloride of ethal.
$C^2\ H^3\ Cl$	$C^4\ H^5\ Cl$
Chloride of amyle.	Chloride of cetyle.
$C^{10}\ H^{11}\ Cl$	$C^{32}\ H^{33}\ Cl$

Thus these are derived from—

Spirit of wood.	Alcohol.
$C^2\ H^6\ O^2$	$C^4\ H^6\ O^2$
Oil of potato.	Ethal.
$C^{10}\ H^{12}\ O^2$	$C^{32}\ H^{34}\ O^2$

by the elimination of O^2, its place not being supplied; while 1 molecule of chlorine takes the place of 1 molecule of hydrogen in the following groups :—

$$C^2\ H^4,\ C^4\ H^6,\ C^{10}\ H^{12},\ C^{32}\ H^{34}.$$

It would become interesting after this to ascertain how volatile bodies, containing 4 atoms of oxygen in their molecule, would behave in the presence of volatile substances; such as benzoic acid, for example; for we ought to return this body, after its losing O^2, to the benzoile group, and, consequently, obtain the chloride of this radical. And this, in fact, takes place.

Benzoic acid, treated with a slight excess of bichloride of phosphorus, is briskly acted on; at about 312° F. hydrochloric gas is abundantly disengaged, and we obtain a large quantity of a product, boiling between 388° and 392° F., which has precisely the same composition as chloride of benzoile. I have also ascertained the density of the vapour, which is in accordance with this supposition. In addition to this, I am satisfied that this product is slowly but completely decomposed, in contact with pure water, giving out hydrochloric and benzoic acids (2 gr. 5 of this product have given me 2·156 crystallised benzoic acid, calculation gave 2·176.) It is, on the contrary, rapidly decomposed in contact with potash, producing an alkaline chloride and benzoate. Treated with pure alcohol its temperature is raised considerably, and produces perfectly pure benzoic ether, which I subjected to analysis. With dry ammoniacal gas it forms sal-ammoniac and benzamide. Finally, it furnished, by distillation with iodides and sulphurets, iodide and sulphuret of benzoile: by analysis, the density of its vapour, and all its reactions, show, then, that this product is identical with the chloride of benzoile: obtained by the direct action of chlorine on the hydruret.

I have since learned that M. Dumas, some

years back, performed a series of experiments in his laboratory, having for their object the action of bichloride of phosphorus on benzoic acid, and that he obtained as the product of this reaction, a heavy volatile liquid, possessing a strong smell resembling that of chloride of benzoile; but which he did not further examine, occupied as he then was on very important experiments.

The results I have mentioned are so clear and decisive that I thought cinnamic and cuminic acids, which have so great an analogy with benzoic acid, would comport themselves in the same manner, and experiment proved the truth of my anticipations. These two acids, in fact, produced, by the action of bichloride of phosphorus, products which, by their composition and general reactions, might be considered chlorides of cinnamyle and cumyle. These last are very slowly converted by the action of pure water into hydrochloric, cinnamic, or cuminic acids, but very rapidly under the influence of an alkaline water, and produce new amides by the action of dry ammoniacal gas.

The acids of the acetic group are far from comporting themselves in so decisive a manner as the preceding, but up to the present time I have not been able to obtain sufficiently satisfactory results to speak of them in this place.

Finally, it was curious to endeavour to discover how a volatile acid, with 6 atoms of oxygen would behave under the influence of bichloride of phosphorus; the action was again the same. We perceive an elimination of 2 molecules of oxygen, their place not being supplied, while 1 molecule of hydrogen is removed, chlorine being substituted. Thus anisic acid $C^{16}\ H^{8}\ O^{6}$ yielded me perfectly pure chloride of anisyle, $C^{16}\ H^{7}\ Cl\ O^{4}$, reproducing anisic acid, under the influence of the alkalis, and, with ammonia, producing anisamide.

If now we recollect that M. Melsens succeeded, by means of the amalgam of potassium, in returning from a chlorated derivate to the primitive substance, by substitution, we may understand how it is possible to convert benzoic acid into oil of bitter almonds, and cinnamic acid into essence of cinnamon.

We can now fix the oxygen on an aldehyd, and transform it into an acid; by means of bichloride of phosphorus we can effect the reverse—that is to say, we can convert an acid into its corresponding aldehyd. Bichloride of phosphorus is, therefore, a valuable agent that will enable us to realise numerous interesting, and easily recognised combinations, by contact with organic substances, because it acts at the same time by removing the oxygen and adding a chloride.

In all the reactions I have tried with this product, I have constantly observed that it formed, in addition to the chloride of a ternary radical, an extremely volatile liquid, which appeared to me to resemble oxichloride of phosphorus. I have not been able as yet to make a sufficient examination to decide this question; in this case, the preceding reactions will explain themselves in a clear and simple manner: thus, in the particular case of benzoic acid, we should have—

$$Ph\ Cl^{5} + C^{14}\ H^{6}\ O^{4} = Ph\ Cl^{3}\ O^{2} + Cl\ H + C^{14}\ H^{5}\ Cl\ O^{2}.$$

ON THE ESTIMATION OF THE SULPHOCYANOGEN IN THE SALIVA.*

BY SAMUEL WRIGHT, M.D.

Sir—In the number of your excellent Journal for May 15th, is an article "On the Presence of Sulphocyanogen in Human Saliva.†" Its author, Max. Pettenkofer, takes an exception to my process for determining the proportion of sulphocyanogen in this fluid, on the ground that the presence of chlorides would interfere with the results. The passage I allude to runs thus:—"To estimate the sulphocyanogen in saliva, Wright advises us to form sulphocyanide of lead, to weigh this, and to calculate the quantity of sulphocyanide of potassium in the saliva from it; but the metallic chlorides, &c., in the saliva inevitably produce error, consequently, according to Wright's experiments, the amount of sulphocyanogen in the saliva is much too great." How Pettenkofer could have imagined that I should advise the addition of a salt of lead to an *alcoholic* extract of saliva, with the object of determining the presence and proportion of sulphocyanogen, I am quite at a loss to conceive. At least I am assured, in the singular mistake he has committed, that he can either have not read in detail my analytical process, though it has been three several times translated into the language of his country, or have paid only very slight attention to it. In either case he does both himself and me injustice in his reference and the reasoning upon it.

To correct the error into which Pettenkofer has fallen, and free myself of the charge of having committed the blunder in question, I will give, sir, with your permission, the process I employ in the analysis of healthy saliva. It will be seen that, instead of advising the

* A letter addressed to the Editor of the *Chemical Gazette*.

† See our last number, page 257.

salt of lead to be added to an *alcholic* extract of saliva, it is to the *ethereal* extract, which, of course, would contain no chlorides.

Filter the saliva through moderately coarse filtering paper. On the filter will remain a solid residuum, and a clear liquid will have passed through.

EXAMINATION OF SOLID RESIDUUM.

It is to be washed thoroughly on the filter with ether, when a residue will be left, and an ethereal solution will be obtained.

EXAMINATION OF THE RESIDUE.

Exhaust with cold distilled water; this dissolves the chlorides of sodium and potassium, which may be obtained by evaporation. The matter left upon the filter is to be dried, weighed, and then incinerated. The amount of loss thus occasioned indicates the proportion of free albumen. A little ash remains, from which distilled water extracts carbonate of soda, leaving undissolved phosphate of lime.

EXAMINATION OF ETHEREAL SOLUTION.

Evaporate carefully to dryness, wash the residuum on a filter with distilled water, and continue to treat with this menstruum until everything soluble in it is removed. The aqueous solution is next to be evaporated to dryness, when a residue of pure ptyaline will be obtained. The matter left upon the filter is a fatty acid, which is to be dissolved in ether, from which again, by evaporation, it may be obtained in a pure form.

EXAMINATION OF FILTERED LIQUID.

This liquid is affected neither by boiling nor by nitric acid; yet it contains albuminate of soda, which can only be separated by means of galvanism. To this end, it is advisable to reduce the liquid, by very careful evaporation, to one-third in volume, and then to introduce the wires of a galvanic battery in action, free soda will collect upon the negative pole, and coagulated albumen upon the positive one. If this process be conducted carefully, all the albuminate of soda may be removed without decomposing the chlorides.

The liquid, having been thus treated, is next to be very carefully evaporated to dryness, and the dry residuum exhausted with ether, which dissolves the lactates of potash and soda, and the sulphocyanide of potassium. These salts (after the evaporation of the ether) having been dried and weighed, are to be dissolved in distilled water, and subacetate of lead added until it shall cease to afford a precipitate. An insoluble sulphocyanide of lead will be deposited, and a soluble lactate will remain in solution. The former, after having been dried and weighed, will indicate the proportion of sulphocyanide of potassium previously existing in the saliva; and by subtracting this weight from that of the original saline matter, the quantity of the lactates will also be determined.

The residuum from which these salts have been separated is to be treated with alcohol, which will remove the remaining chlorides of sodium and potassium, the weight of which is to be added to that of the former amount of the chlorides of the same metals.

After the extraction of the chlorides, the soda which remains in the form of carbonate, is to be neutralised by acetic acid, and the salt dissolved out by alcohol; by evaporating the alcoholic solution to dryness, and exposing the salt to a red heat, the acetic acid will be destroyed and the soda left.

The remaining solid matter is to be dried, weighed and incinerated. The loss by incineration determines the amount of mucus.

The saline matter left is to be boiled in distilled water, which will generally remove a little sulphate of potash or soda—usually a phosphate of soda.

The last residuum will be phosphate of lime; its weight must be added to that of the undissolved phosphate of lime.

Silica is mentioned as a constituent of saliva. I have never met with it, though I have occasionally discovered in it a trace of iron.

The analytical process just described will perhaps be rendered more intelligible by reference to the subjoined diagram:—

SALIVA—FILTRATION.

1. Solid residue.

1. Ethereal solution evaporated { Aqueous extract—Ptyaline. / Ethereal extract—Fatty acid.
2. Aqueous solution evaporated { Chlorine of sodium. / Chloride of potassium.
3. Residue incinerated..... { Loss—Albumen. / Ash { Soda. / Phosphate of lime.

2. Filtered liquid.

1. By galvanism ..... Albuminate of soda.

2. Filtered liquid dried
- 1. Ethereal solution evaporated → Lactates. / Sulphocyanides.
- 2. Alcoholic solution evaporated → Chloride of sodium. / Chloride of potassium.
- 3. Residue neutralised by acetic acid. Alcoholic extract incinerated—Soda.
- 4. Residue by incineration → Loss—Mucus. / Ash → Phosphate of soda. / Sulphate of soda. / Phosphate of lime.

As far as my analyses of saliva enable me to judge of this fluid in its healthy state, the following are its ordinary constituents and their proportions:—

Water	988·10
Ptyaline	1·80
Fatty acid	0·50
Chlorides of sodium and potassium	1·40
Albumen, with soda	0·90
Phosphate of lime	0·60
Albuminate of soda	0·80
Lactates of potash and soda	0·70
Sulphocyanide of potassium	0·90
Soda	0·50
Mucus, with ptyaline.....	2·60

I have no opinion to offer upon Pettenkofer's process for determining the proportion of sulphocyanogen in saliva, further than that, though it may be accurate enough, yet I do not consider it nearly so simple, and by no means more sure, than the one I ventured five years ago to propose.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON FERMENTATIONS AND THE IMPORTANCE OF THEIR STUDY BY THE MEDICAL PRACTITIONER.*

BY DR. A. BOUCHARDAT.

(*Continued from page* 274.)

APPLICATIONS.

The experiments and observations which I have detailed were undertaken in a purely theoretical point of view. But the question of alcoholic fermentation touches on so many points of rural and manufactorial economy, that I think it would be of service to develope the principal applications resulting from my researches. I shall allude more especially to the conditions of the manufacture of wines, the causes of their diseases, the means of preventing or removing them, and the art of preparing, by means of fermentation, liquids well-charged with alcohol, and intended either to be drunk, or to be distilled. I shall begin by the last named important subject.

* *Med. Times.*

ON THE PREPARATION OF LIQUIDS WELL-CHARGED WITH ALCOHOL.

In the generality of distilleries, it is important to convert the saccharine matter rapidly into alcohol, in order that the work may be constantly going on. In this case there should be no hesitation; the most energetic alcoholic ferment, the yeast of beer, should be employed, and the temperature should be regulated in such a manner as to obtain the conversion of the sugar into alcohol in the minimum of time. But it must be admitted that many difficulties are inherent in this manner of proceeding. The elevation of temperature assists other transformations than that of the sugar into alcohol, and when that principle is produced, it is found in conditions favourable for its conversion into acetic acid.

We have especially to fear partial effects, the lactic, butyric, carbonic, amylic, and mucous transformations, and other fermentations, the existence of which may be demonstrated by further study. It is certain that in the operations of the manufacture, the theoretical results are rarely obtained, and very often far otherwise.

The use of the lees-ferment, the production of which I have recently explained, and which I can multiply at will, enables us to obtain a perfect concord between theory and the practice of factories. At the low temperature at which this decomposes the sugar, other transformations are not to be feared. In many experiments I have obtained the quantities of alcohol indicated by theory, and I have never met with foreign products in the liquids. We may have liquids very rich in alcohol, containing more than 17 per cent., a proportion which has never been reached in the rapid fermentations. This richness of the fermented liquids renders the distillation more easy.

But the process of slow fermentation will never become general in distilleries, because the transformation requires a great deal of time for its completion (from three to five months), which would require a much larger capital, and a great many vats; and to prevent all chance of the production of acetic acid, the vats must be kept very cool. Nevertheless I am convinced that in certain particular conditions, especially when the distillery is connected with agricultural works, the process of slow fermentation will offer great advantages.

The process of slow fermentation applied with intelligence, by employing glucose, and varying the nature of the aromatic substances, enables us to obtain fermented liquors as rich as the most generous wines, such as may be easily kept, and which may very usefully replace the vapid drinks, which, in many departments of France, form the sole strengthening drink of the labourer.

Before concluding what I have to say on the slow fermentations, I may mention the following remarks which are deducible from my observations, and which I think it important to notice. 1st. All things being otherwise equal, alcoholic fermentation is carried on the more rapidly in proportion to the larger size of the ferment-globules employed. 2nd. The fermentation is completed at a lower temperature, and the resulting fermented liquids are so much the more rich in alcohol, in proportion to the smaller size of the ferment-globules.

THE PREPARATION OF WINES.

It is an established rule in almost all wine countries that the fermentation of grape-must is better, the more rapidly it is carried on; the vine-dressers, therefore, watch the development of fermentation in the vats with great interest, and sometimes employ an artificial heat to render it more active.

It is certain that when the year has been favourable, and must obtained from grapes of good quality is acted on, the produce is very good, but in bad years, when the fruit is immature, or of inferior quality, the wine is not as it could be wished. It is under such circumstances that improvements in the manufacture of wines are necessary; they ought to be able to place the grape or the must in such circumstances, that before undergoing the alcoholic fermentation, it should experience the modifications which may render it mature.

They ought, also, in those years when the wines are poor in alcohol, to place the must in such circumstances that the transformation of the sugar into alcohol may be complete, and the access of air should be carefully prevented, as it might destroy the alcohol, or impede its formation.

The experiments which I have adduced in my memoir lead naturally to a result previously unforeseen, and which is contrary to what is generally practised; it is, that instead of hastening the fermentation, it should be slackened; instead of producing tumultuous alcoholic fermentation, terminated in a limited number of days, we should contrive so that the sugar may be changed into alcohol and carbonic acid by means of a slow fermentation. The transformation, instead of being effected in three or six days, ought to continue for three or six months.

This object will be obtained by placing the must with the grape, before fermentation commences in cellars the temperature of which does not exceed 54° F.

It must be fully understood that the progress of the fermentation should be watched daily in order to keep the barrels full, to prevent the access of air, and that, if possible, the grapes should be previously pressed within bounds which experience will teach, in order not to obtain a wine too much charged with the soluble principles of the grape.

If the views which I have just stated are correct, the comparison of the red wines with the white of the same growth and the same year ought to teach it. In fact, if the fermentation of red wines is essentially a rapid fermentation, that of the white wines approaches nearly to the slow fermentations. All things being otherwise equal, the white wines should therefore be richer in alcohol than the red. I have ascertained the quantity of alcohol contained in red and white wines prepared the same year from grapes of the same plant, collected in the same vineyard: I found 11 per cent. in the red wine, and 13 per cent. in the white; this difference of about two per cent, is always remarked in the comparative analysis of the red and white wines of the same year and of

he same growth. By consulting the table at the end of this memoir, it will be seen that the white wines of the same year and of the same growth, are almost always richer in alcohol than the red wines.

DISEASES OF WINES.

The greater number of the spontaneous alterations of wines depend on the modifications which their azotised matters undergo under the double influence of the access of air and the elevation of temperature; we may even lay it down as a general rule that all wines which contain more than seven per cent. of alcohol, and which are kept in well-stoppered vessels, and at a temperature never above 54° F., are preserved for a long while without alteration, and ultimately become very good.

The following experiment will show the powerful influence of temperature in causing specific alterations in wine. Some white wine of Nanchévre, to which I have previously alluded, was bottled without being fined; it was, nevertheless, perfectly limpid; after the lapse of a few days, it became turbid, as I have already stated. The greater number of the bottles were kept in a very cool cellar; it gradually cleared, and even improved in quality, depositing at the same time the black ferment. Some bottles of the same wine were kept in a cellar, the temperature of which varied from 50° to 59° F.; it became ropy, like the white of egg; it had undergone the viscous fermentation. Thus, in the same wine kept in bottles equally well-stoppered, a difference of some degrees in the temperature caused very different molecular modifications.

The remedy, which in my opinion may be usefully applied to all sick wines containing more than seven per cent. of alcohol, and which have not turned sour, is to preserve them in well-stoppered bottles, and at the lowest temperature possible. Thus we should employ—and it is serviceable to do so—the same means to prevent the spontaneous alterations of wines, and to restore those which already spontaneously sick.

ON ACESCENCE AND ACETIFICATION.

Acescence is the most annoying disease; it always occurs from the absorption of oxygen. It is generally supposed that its sole effect is to change alcohol into acetic acid, but the following results from experiments which I take from a former memoir on acetification, appear to me to indicate that the phenomenon is not generally so simple as it is supposed to be. Lowitz had seen, and I have verified it several times, that wines become acid spontaneously, contain as much alcohol as after their acetification. Th. de Saussure has stated, and I also observed it in this case, that the oxygen gas absorbed was replaced by a nearly equal volume of carbonic acid, which does not occur in the acetification of alcohol.

I allowed some wine containing 7·2 per cent. of alcohol in a flask half full to become acid at a temperature of 52° F.: it was acidified after the lapse of a fortnight, and the acid having been saturated, it still yielded 7·2 of alcohol. It appears to me that this first phase of acescence which is effected at a low temperature under the influence of oxygen, transforms either the mucous matters or the sugar remaining in the wine, into acetic acid with the disengagement of carbonic acid, in volume equal to that of the oxygen absorbed.

The transformation of alcohol into acetic acid by acetification belongs to another order of phenomena, which spring entirely from the *cadre* of fermentations, if they are restricted, as I believe they should be, to the facts which are comprised in the following definition: "fermentations are the transformations of organic or other matters in solution in water under the influence of organised living beings, or of a special azotised matter acting without the contact of oxygen."

Fermentations being thus defined, the transformation of alcohol into acetic acid ought no longer to be classed among the fermentations; for the intervention of an organised and living ferment is in no way useful in determining this transformation, and the presence of a large quantity of oxygen is indispensable. It is merely a phenomenon of slow combustion; organic matter, such as the decoction of malt, the juice of the potato, of the helianthus annuus, or the azotised matter of wine, intervene only to absorb the oxygen, and afterwards transmit it to the alcohol, as does the porous platina, and as does also the deutoxide of azote in the preparation of sulphuric acid.

If azotised organic matters are employed, such as the white of egg, gluten, or caseine, which do not actively absorb oxygen, the transformation does not take place, as I have already shewn.

Mothery vinegar, and the vegetations and vibriones which have been discovered in vinegar, do not at all assist in the accomplishment of this phenomenon. The acetification of alcohol is only a slow combustion, and not a fermentation.

TABLE PRESENTING THE RELATIVE PER CENTAGE OF ALCOHOL IN SEVERAL WINES AND FERMENTED LIQUORS.*

Wine produced by the influence of the lees-ferment	13·80, B†
Strong beer produced by the influence of the lees-ferment	15·17, B.
Wine produced by the influence of the black-ferment	16·64, B.
—— of Bagnols, containing sugar	15·16, B.
Red wine of Avallon, (Yonne) 1834, first growth, (Jura chalk district)	11·14, B.
White wine of Nanchévre, (Yonne), 1841, (chalk district of the Jura)	9·99, B.
——— (Yonne), 1842, (chalk district of the Jura)	12·50, B.
—— of Pineau Girolles, (Yonne) 1842, (oolithic chalk district)	12·54, B.
Red wine of Saint Georges, (Hérault), 1839	11·40, B.
Wines of Tonnere (Yonne).	
Red wine, côte Pitois, 1839	10·00, J.
——— ———, 1840	11·00, J.
——— of Bridaines, 1839	9·33, J.
———, Vautiercellins, 1840	10·33, J.
White wine, Charlouts, 1842	11·33, J.
——— , Vaumorilon, 1842.	11·66, J.
Wines of Lot.	
Red wine of Cahors, 1790, (chalk district)	11·00, C.
———, 1800, ditto	11·13, C.
———, 1802, ditto	11·00, C.
———, 1810, ditto	11·66, C.
———, 1811, ditto	12·00, C.
White ditto, 1811, ditto	12·33, C.
Red ditto, 1818, ditto	10·66, C.
White ditto, 1818, ditto	11·33, C.
Red ditto, 1822, ditto	11·33, C.
White ditto, 1822, ditto	12·33, C.
Red wine Saint Jean de Lourd, 1826, ditto	13·00, C.
—— of Cahors, 1840, ditto	10·33, C.
White ditto, 1840, ditto	11·00, C.
Red ditto, 1842, ditto	11·00, C.
White ditto, 1842, ditto	11·00, C.
Rose ditto, 1842, ditto	11·33, C.
Medium of the proportion of alcohol in the wines of chalk districts	11·36, C.
Red wine of Cahors 1820, clay district	11·00, C.
White ditto, 1820, ditto	11·33, C.
Red ditto, 1822, ditto	9·66, C.
White ditto, 1822, ditto	11·00, C.
Red ditto, 1842, ditto	9·00, C.
White ditto, 1842, ditto	10·00, C.
Rose ditto, 1842, ditto	10·00, C.
Medium of the proportions of alcohol in the wines of the clay districts	10·00, C.
Wines of Tarn and Garonne.	
Red Wine of Cot, 1837, (compact chalk district)	10·60, Bn.
———, 1840, ditto	10·00, Bn.
White ditto 1840, ditto	10·10, Bn.
Red Wine of Reveille, 1842, (schistous chalk district)	9·33, Bn.
———, Bartherac, 1841, (compact chalk district)	9·10, Bn.
———, Goux, 1842, (chalk clay district)	9·65, Bn.
Wines of Lot and Garonne.	
Red wine Therac, 1841, (free-stone)	10·60, Bn.
White wine Gaillardel, 1840, (oolithic district)	9·33, Bn.
Red Wines of La Gironde.	
Blaye, 1841	10·25 F.
Saint Martin, 1841	10·62 F.
Saint Savin, 1841	9·10 F.
Saint Emilion, 1841	9·18 F.
Saint Sulpice, 1841	8·90 F.
Genissac, 1841	9·05 F.
Lussac, 1841	9·00 F.
La Réole, 1841	8·50 F.
Saint Macaire, 1841	7·80 F.
Saint Maixent, 1841	8·75 F.
Bazas, 1841	9·00 F.
Bordeaux, 1841	10·10 F.
Blanquefort, 1841	9·10 F.
La Mission, 1841	10·12 F.
Saint Médard, 1841	9·25 F.
Castre, 1841	9·60 F.
Saint Laurent, 1841	9·00 F.
Pessac, 1841	9·00 F.
Pauillet, 1841	9·71 F.
Château-Lafitte, 1840	8·70 F.
Château-Margaux, 1840	8·75 F.
Château-Latour, 1840	9·35 F.
Tronquois-Lafond, 1840	9·90 F.
Palus Saint Vincent, 1843	10·30 B.
Saint Macaire, 1843	8·00 B.
Duchâtel-Saint Julien, 1838	8·67 B.
White Wines of La Gironde.	
Castellon	11·00 F.
Lussac	9·25 F.

* The tables of the quantities of alcohol contained in wines and stated in works on chemistry, are not correct; either the authors have analysed wines to which alcohol has been added, as often happens when the wines are for exportation, or they have not correctly reported their number to absolute alcohol; the results which I present in this table have been ascertained by the centesimal alcoholmeter of Gay-Lussac.

† The initials indicate the names of Bouchardat, Jacob, Clary, Bouysson, and Fauré.

La Réole	9·00 F.
Saint Macaire	8·15 F.
Sauterne	15·00 F.
Bomme	12·15 F.
Barsac, first growth	14·75 F.
Poudeuzac, first growth	13·75 F.
Sainte Croix-du-Mont	12·15 F.

RÉSUMÉ.

1st. I have described two alcoholic ferments distinct from that of the yeast of beer, by their form, colour, the dimensions of the globules, the manner in which they decompose sugar, and the medium in which they live.

2nd. The ferment-globules contain, like other organised beings, immediate principles, and very different salts.

3rd. The proteic animal substance, which constitutes the essential part of ferment, differs from albuminous matters by an excess of oxygen, which is no less than two per cent.

4th. The ferment-globules contain two different proteic matters, an enclosed substance which is soluble in water containing 0·001 of hydrochloric acid, and another enveloping substance, which is insoluble in that liquid.

5th. The cerebral matter of the adult man causes the alcoholic fermentation after the lapse of forty-eight hours.

6th. The globules of alcoholic ferments present the most complete analogy with the nervous globules of the higher orders of animals.

7th. When, in definite conditions, the ferment globules ramify and are changed into vegetable infusoria, they have lost their power as ferments, they no longer possess the power of decomposing sugar and water.

8th. A solution of albumen in filtered sugared water, exposed for two months to a temperature of 68° F, does not undergo the alcoholic fermentation, whilst the same solution precipitated by tannin ferments after the lapse of forty-eight hours.

9th. A solution of white of egg, or a solution of wheat-gluten added to sugared water, ferments under the influence of the ferment-globules. These albuminous matters are not assimilated by the globules of ferment. If, in the brewers' vat, we find seven parts of ferment when one only has been used, it depends solely on the fact that the one part of ferment has met with proteic substances, which, placed in a fermenting medium, are capable of giving spontaneous origin to ferment-globules.

10th. The decomposing action of ferments is an action of contact, but is also intimately connected with the life of the globules.

11th. If, in the preparation of red wines, the process of slow fermentation is carefully substituted for the rapid fermentation, wines containing a larger proportion of alcohol will be obtained.

12th. The process of slow fermentation allows us to obtain at will fermented liquors as well charged with alcohol as the most generous wines.

13th. To prevent the alterations of wines, to restore those which are sick, which contain more than seven per cent. of alcohol, and which have not turned acid, it is sufficient to keep them in well-stoppered bottles, and at the lowest temperature possible.

14th. There are two phases in the acescence of wines:—first phase, the sugar or the gummy matters of the wines are changed into acetic acid; that is, by fermentation;—second phase, the alcohol under the influence of oxygen is also changed into acetic acid; but this is not by fermentation, but a slow combustion, which is in no way connected with the vitality of the organised globules.

A LIMIT TO HIGH CULTIVATION.

In the course of last year I pursued my experiments as to the effects of artificial manures upon root crops, but the results were so unsatisfactory that I was unwilling to encumber your pages with their unprofitable details; but there is one error so prevalent in the present day among those who, without any practical knowledge upon the subject, speculate upon the improvement of agriculture, that any evidence tending to remove it may be of some service. The error to which I allude is that of supposing that the application of capital to land is an infallible recipe for augmenting its value to an indefinite extent, and that a generous liberality to the soil is sure to be repaid by a proportionate increase of produce. Mr. Pusey has shown that doubling the quantity of farm-yard manure does not double the value of the crop, and that the return for 26 loads of it, is very little more than that for 13. My experiments prove the same general fact with respect to artificial manures. I must begin by stating that in one case I found that 20 bushels of bones produced nearly half a ton per acre more of Swedes than 4 cwt of guano in another part of the same field. The issue of the experiment was this—

	tns.	cwt.	lb.
20 bushel of bones produced per acre..	29	2	96
4 cwt of guano	31	12	16
20 bushel of bones and 4 cwt. of guano	30	10	80
8 cwt. of guano	31	12	16

Thus, it would seem, the addition of the guano increased the produce of the bones

nearly in the same proportion as the addition of the bones diminished the produce of the guano, and yet in the other instance the bones were superior to the guano. It cannot be inferred from this that the plants were injured by excess of manure, in consequence of the two being united, for the crop was a large one; we can only infer that the soil had reached its maximum of fertility. But it is still more remarkable that doubling the dose of guano produced no effect whatever, not even the difference of a single pound in the produce. Now, the only other great expenditure, by which it is expected that fertility can be materially increased; is that which is incurred by draining, and doubtless in all stiff soils it is most efficient for that purpose; but there are other soils which derive no benefit from it at all—the sands, and the gravels, and the chalk, occupying a very large proportion of the whole country, being naturally porous, are drained by nature, and want no assistance from art. There is, therefore, a limit to their powers of productiveness which it is impossible to pass; and those who have attained that limit may expend the wealth of Golconda upon their land without adding a single ounce to the food of the country; or, rather, like the dog in the fable, they may lose the good they have by grasping at too much; for no farmer needs to be told that a crop may grow too rank and stand too thick upon the ground for profit.

Hence it follows that the best cultivators of the soil are those who will suffer most severely from the threatened reduction in the price of corn; they cannot obtain more from it, and it will pay them less; and to them the cry of "Improve your agriculture," is a senseless and ignorant reproach. Nevertheless, it is quite true that much of this land, apparently in the best condition, has not attained its maximum of fertility; but the question how to bring it up to that mark is a problem too difficult of solution to be imposed upon the ordinary farmer, who cannot be expected to venture upon greater risks than those to which he is already too much exposed from the elements and insects. For his encouragement, therefore, it may not be amiss to show, by a series of experiments on Mangold Wurzel, that in some cases where a soil may be supposed to have reached very nearly to its highest point of fruitfulness, it may still have latent powers of production capable of farther development. They were tried in a field which had been well manured in the preceding year, and the soil must have been tolerably rich, which, without any additional manure, could bear a crop weighing 18 tons 7 cwt. 16 lbs. The following table exhibits the increase extorted from it by different manures:—

	tns.	cwt.	lbs.
1½ cwt. phosphate of potash and 20 bushels of ashes	0	5	20
4 cwt. essence of guano and 20 bushels of ashes	1	14	32
20 bushels of sugar scum and 10 bushels of ashes	3	3	64
20 bushels of bones and 10 of ashes	3	12	96
4 cwt. of guano and 20 bushels of ashes	6	12	96

The two first of these do not cover the expense; and yet the second ought to contain all the same elements of nutrition that exist in the fifth, which was amply remunerative. On the other hand, the actual increase shows that the plants were not injured by the concentration of the manure, and the difference between them cannot be explained in that way.—*L. Vernon Harcourt.*

ON THE MANUFACTURE OF STEEL.

BY DR. CARL SCHAFHAEUTL.*

IRON, in the composition of which a portion of the silica is replaced by manganese, will, while being smelted, rather part with the latter than the former. From this it follows, that at the moment when the iron is on the point of passing from a liquid to a solid state it will retain sufficient silica to form steel. For this reason, during the whole process of refining, the current of air is caused to act rather upon the surface of the metal than through the interior of the fluid mass, in order to avoid the combustion of too much carbon and silica; from which it follows that the casting becomes malleable without losing a sufficient quantity of silica to constitute iron, properly so called, and the product is raw or blistered steel. The casting which does not contain any manganese, loses, by the effect of combustion, a portion of silica proportionable to the quantity of carbon burnt, and furnishes iron only, as a definite product.

It is simply to the mechanical action of the hammer that the distinctive features of steel, as compared with cast metal, are due. In order to effect this change, the blistered steel is broken into pieces and melted down; they are afterwards tempered—again broken into pieces, and welded together at a good welding heat. The steel will be the more malleable, and possess more tenacity and uniformity of texture, in proportion to the number of times these operations are repeated. The product is called "wrought or shear steel."

* *Revue Scientifique et Ind. du Dr. Quesneville*, and *Newton's Journal.*

STEEL OF CEMENTATION AND CAST-STEEL.

When bar-iron is heated to a white heat, or even melted in close vessels containing coal or carbonaceous substances, it takes up a certain quantity of carbon, and is transformed into castings of various kinds.

If the iron contains, together with silica, phosphorus and arsenic in proportions suitable for softening the granular particles of iron during their combination with the carbon, by keeping it for a certain time at a red heat, with powdered charcoal, a casting is obtained, which, when submitted to the action of the hammer, or of rollers, furnishes a product known as "steel of cementation." During this operation, the stratum of oxide which covers the particles of iron inside loses its oxygen, and passes again into a metallic state; but the vacant spaces occasioned by this are filled up, as the ferruginous particles, which are in a semi-fluid state, re-assume the crystalline form. The carbonic oxide gas, in escaping, forms large blisters on the surface of the metal, under which the softened mass crystallises. On being broken, the interior of these blisters, instead of appearing of a dark colour, indicating the presence of a stratum of protoxide, present a brilliant and rainbow-tinted appearance, the yellowish and bluish tints distinguishing bronzed steel being observable. If this steel be wrought at a white heat, these blisters will weld in with the mass with the greatest facility. During cementation, the carbon combines with the component particles of the iron in various proportions, depending in a great degree upon the chemical composition of those particles. It is, therefore, a vulgar error to suppose that steel of cementation contains more carbon at the surface than in the interior, as stated in all technological treatises. Thus, in the best Dannemora steel, it very frequently happens, when the cementation is finished, that the centre of the metal contains a much greater quantity of carbon than the superficial portions. It may also happen that steel produced from the best Dannemora bar-iron will differ in an extraordinay manner as regards hardness, in various portions of the bar; and for this reason, in steel works in England, the bars of steel are always broken into several pieces, in order to class those pieces together which are the most similar in quality.

If ordinary iron be submitted to cementation, that is to say, iron in which the proportion of silica is ordinarily insignificant, when compared with that of carbon, and that independently of this the iron is deficient in the quantity of phosphorus and arsenic necessary for easily softening the metallic molecules, only carburet of iron and a little siliciuret of iron are produced, but the carbon does not combine with the silica. In this case the steel obtained is deficient in malleability and tenacity—for this reason, that molecules will not unite or crystallise until they have taken up a quantity of carbon more than sufficient to produce steel. With regard to simple carburetted iron (when it contains more carbon), it either will not harden at all when tempered, or becomes friable and brittle when heated to redness, even when it does not contain more carbon than steel of good quality.

The fracture of the steel of cementation, now under notice, is gray and dull, while steel of good quality is of a silvery aspect, and presents cubical crystals.

The best steel can only be obtained by the cementation of forged iron. Whilst the metal is combining with the carbon, the iron must not enter into a complete state of fusion, as in that case groups of crystals, each possessing a different degree of carbonization, would be formed; even the best Dannemora iron will not furnish a uniform product fit for purposes of commerce when melted with substances containing carbon. I am well aware that the experiments of Clouet, Hachette, and Bréant, may be opposed to me, as set forth in various treatises upon chemistry, but these are unfortunately mere laboratory experiments, the authors of which have prudently concealed, or passed over in silence, all those which were unsuccessful. When the operator has obtained a regulus at the bottom of his crucible, and when, after immense trouble, he has succeeded in extracting from it a small portion of steel capable of being worked, he immediately hastens to publish his pretended discovery in some journal, of which others become faithful and credulous echoes; thus, since the manufacture of steel has become the subject of chemical inquiry, complaints are daily becoming more frequent upon the difficulty of procuring steel capable of resisting the treatment to which it is subjected in the arts. If the persons who preside over the coining departments either at London or Munich, were consulted, they would all agree in saying that it is now very difficult to meet with the quality of steel necessary for making the dies. Even in England good steel becomes more and more scarce. With regard to the manufactories of cemented or cast-steel established upon the continent, they furnish products, the quality of which is so uncertain, that the workman is often reduced, after having lost his time and trouble, to throw certain portions

away, as they want the necessary uniformity and tenacity.

All the artificial alloys of steel with silver, of which so much has been said, are not fit for anything, and are never met with in commerce.

When the steel has been withdrawn from the cementing furnace, and after it has been broken, and the pieces drawn out, they are submitted to one of the two following operations:—The pieces after being sorted are piled one upon the other and welded together (this is called faggoting the steel), or the sorted pieces are placed in clay crucibles of a nearly cylindrical form, and cast in a reverberatory furnace, in which two crucibles are placed, one behind the other, upon cakes of fire-clay; the orifice of these crucibles is closed by a flat cake of fire-clay. The bars of cemented steel, as above mentioned, are divided into pieces of one or two inches in length; these pieces are distributed, according to their degree of carbonization, in vessels fixed to the walls of the place in which the melting is carried on.

These different qualities of steel are generally combined in such a manner as to obtain a product the best suited for the purposes to which cast steel is ordinarily applied.

In all treatises on practical chemistry, it is asserted, that in order to melt steel, it is to be covered with a layer of glass or blast furnace slag; that the opening of the crucible is luted, or at least becomes firmly fixed during the operation; these assertions are, however, erroneous. In the first steel manufactories in Sheffield steel only is put into the crucibles. With regard to the cover, it is evident that it must not adhere to the crucible, as it is necessary the operator should remove it from time to time with a bar of iron, in order to ascertain the state of the metal.

In order to obtain steel of the best quality, it is not sufficient that the melted mass be run into moulds: the most essential point is to make the casting at the proper time, and for this purpose the operator must be guided by the quality of the steel. This is the duty of the workman, who from long practice can tell the suitable point of fusion, either by simple inspection, or by means of his bar of iron, with which he merely touches the surface of the metal, being most careful not to plunge it into the melted mass. As the quality and uniformity of the steel depend in a great measure upon the experience and judgment of the workman who directs the casting, it follows that, even in England, a good caster is much sought after and well paid.

It is not difficult, therefore, to explain why so many of the attempts made to establish manufactories of cast-steel in Germany have failed, and will again fail. Thanks to the errors propagated by technical works, and by the assertions of superficially-informed travellers, who had frequently been purposely deceived, it was imagined that, in order to obtain English steel of good quality, it was only necessary to melt cemented steel in a crucible, and afterwards pour it into moulds, when in a state of fusion.

As soon as a crucible is emptied, it is replaced in the oven; each crucible serves for one day's work, *i. e.*, four or five castings, after which it is thrown aside. For ordinary purposes, the steel is run into cast-iron moulds of a prismatic form, previously heated and closed. When the steel is required for making saw-blades, plates, &c., it is run into large moulds of a parallelopiped form. Steel, which is very hard and highly carbonized, contracts considerably in the moulds; great skill is therefore required to run it into the moulds in such a manner that no vacuum may be produced. In that part of the prism corresponding to the jet, a funnel-shaped aperture from one to two inches deep is formed; this is detached and melted down with other pieces of steel.

The transverse fracture of a prism of hard steel is silvery, and has a number of rays radiating from the centre; steel less hard is, on the contrary, of a uniform granular and crystalline texture. This steel possesses all the brittleness of cast metal.

By fusion, steel of cementation acquires peculiar properties, and does not sweat so much as before casting.

When steel is produced from iron of bad quality, and carburets of a different nature are produced during cementation, the melting, instead of improving it, renders it much worse, as, in that case, the different carburets of iron, which are of inferior quality, separate still more during cooling. This has given rise to an old saying, well known among English founders, that "when the devil is put into the crucible, nothing but the devil will come out."

It is to the existence of these heterogeneous metallic carburets, which are produced during cementation in iron of inferior quality, and which form new combinations during the fusion of the metal, that the complaints of workmen working in steel are to be attributed. In fact, these carburets being only, so to speak, agglutinated, even in bars of forged steel, each of them, at the moment of tempering, is contracted or dilated more or less than the one immediately adjoining it, so that from that time a separation commences between the unequally-carbonized

layers; in other words, a flaw or crack is produced, which may be distinguished by a peculiar noise at the moment when the steel is plunged in the water, or, at least, there is a tendency to separation, which only requires the co-operation of an exterior cause, such as a shock, to effect it. This is often observed in razors, &c.

The transverse fracture of cast-steel ought to present a perfectly homogeneous surface, when the bar is broken by a sharp blow, after being cut or marked with a chisel. The slight inequalities which are perceptible ought to be undulating, and to blend insensibly at their bases with the rest of the metallic surface. When, on the contrary, they stand out perpendicularly, the conclusion may be arrived at, that this portion of the bar was the point of contact of two unequally-carbonized layers, which, by separating, either at the moment of tempering, or at a later period, had inevitably given rise to this rupture.

ON THE COMPARATIVE VALUE OF OLEIFEROUS PLANTS.*

BY WILLIAM TAYLOR, F.L.S.

Having paid great attention to oleaginous seeds for many years, both as regards the culture, extracting oil, and applying it to various useful purposes, I now present you with a table, exhibiting at one view the number of each plant, scientific name, English name, native place, oil produced, and how applied in the arts and manufactures, this being the first table ever published.

No.	Scientific name.	English name.	Native place.	Weight of Oil per qr.	The oil how applied in the arts and manufactures.
				lbs. lbs.	
1	Camelina	Gold of pleasure	Siberia	120 to 140	For illuminations, in the manufacture of woollen goods, soap, &c.
2	Sativa Guizòtis..	Niger plant	East Indies	120 ,, 130	For lubricating machinery, making of soap, and used as a salad oil.
3	Oleifera Sesámum	Oily grain	East Indies	130 ,, 160	Burning in lamps, &c. &c.
4	Oriental Brássira	Oil-bearing rape	Britain	120 ,, 140	Lubricating machinery and burning in lamps.
5	Napus Linám .	Common flax	Britain	96 ,, 112	Painting of houses, making of varnishes, &c.
6	Usitatissimun Sinápis	Common mustard	Britain	120 ,, 130	Used in the arts, &c. &c.
7	Nigra Erura....	Cultivated erura	S. of Europe	115 ,, 130	Burning in lamps, lubricating machinery, &c. &c.
8	Sativa Papaver ..	Poppy, cultivated	England	140 ,, 150	Applied in the arts, &c. &c.
9	Somniferum Sinápis	Chinese mustard	China	90 ,, 120	Lubricating machinery, &c., &c.
10	Chimensis Neslia	Cultivated neslia	Europe	95 ,, 112	In the manufacture of woollen goods, soap, &c. &c.
11	Sativa Cannàbis	Hemp, common	India	120 ,, 130	Used in the fine arts, &c. &c.
12	Sativa Madia....	Madia, cultivated	Chili	100 ,, 115	In the manufactre of woollen goods, lubricating machinery, &c.
13	Sativa Helián-thus Annuus	Sunflower, common	S. America	79 ,, 100	Burning in lamps, for woollen gds, soap, and used as a salad oil, &c.

ON THE COMPARATIVE VALUE OF DIFFERENT MANURES.

At the usual monthly meeting of the Blyth Farmers' Club, a most interesting lecture was delivered by Mr. Heywood on the above important subject. In the course of his observations the lecturer observed :—The Peruvian and the African guano were the most valuable, whilst the Saldanha Bay, and many of the compounds sold as guano, did not contain any proportion of the valuable elements contained in the former. The first guano was known to be the excretions of the birds which fed entirely on fish, and consequently contained the same elements as the fish themselves. It is found in beds of immense thickness on the Peruvian and African coasts, where it has been exposed for ages, and has undergone considerable decomposition. Uric acid, and other organic substances, of which the excretions of pisciverous birds are known to be principally composed, being converted into salts of ammonia, dissolved and washed away by the sea spray continually dashing over them, while the phosphates, &c., less prone to decomposition, remain in considerable quantities. The Peruvian guano, which was by far the most valuable, was deposited in a

* *Farmers' Journal.*

hot climate, where the sun has such power that were a piece of meat exposed to it would be dried up, and would not putrify. This guano contained the whole of the nitrogen and the whole of the phosphates secreted by the bird, and the moment it is exposed to rain it undergoes putrefaction, and the ammonia becomes converted into food for plants. This was the case with African guano, which contained a larger amount of salts of ammonia, but a much less quantity of matter capable of being converted into food for the plant. Saldanha Bay was also an inferior guano, and was little better perhaps than those composts made in Sheffield and other large towns, which are composed chiefly of the dried excrements of man. He had a specimen of this description lately sent him by Lord Wharncliffe, who had purchased a large quantity. It had not a particle of guano in it, and was made entirely of sawdust, gypsum, and other articles of little value. If they bought guano, Peruvian or African was decidedly the cheapest, for they contained the greatest proportion of phosphates. Guano should never be mixed with lime or caustic vegetable ashes, before applying, as these decompose the salts of ammonia, and dissipate the gas. The proportion of two or three cwt. per acre, with a little sulphate of potash, common salt, or gypsum, would insure a crop of turnips on good land in ordinary seasons, without any other addition whatever. No doubt they had heard of guano failing for wheat or barley, and this was repeatedly brought forward as evidence against it; yet the parties who made the experiment had never considered that the failure was owing to the absence of silicate of potash in the soil, which guano does not contain. Were that present in considerable quantity, then would the guano be beneficial; on the contrary, were it deficient, then would it have no effect. It was absurd to compare yard manure with guano for wheat, as the former would generally prove the best while a mixture of the two would be better than either alone: trials on turnips with due regard to the composition of the soil would soon prove its superiority for this crop. There were, however, other tillages which could be used in restoring the fertility of the soil, and which might be obtained at a less cost than guano. Bone manure was one of these substances; there were four kinds of bones, all of which differed in value very materially: the fresh bones containing all the fat and gelatine, amounting to more than 50 per cent. of their weight; the boiled bones, from which the fat and a portion of the gelatine had been extracted; the bones from glue-works, and the burnt bones, which consist almost entirely of phosphate of lime: the latter being the substance of by far the greatest importance, should, in all cases, be purchased in preference to the former, particularly when they are to be dissolved. The solution would be nearly double the value of the former solutions of bones, like all other manures it should never be put on until spring, as they would be lost on draining. Some discussion had taken place on a recent occasion, as to the practicability of reducing bones to a fine powder similar to flour. He had then stated that could this be accomplished, they would be of equal value with dissolved bones, but it was not thought practicable to reduce them to such a state. A sample, however, had since been sent to him by Mr. Penistone, of Oldcoates, which was perfectly reduced to this state, and who saw no reason to doubt that any quantity could be ground with the greatest facility. In this state it might be applied to the land as readily as dissolved bones, and two cwt. of it would be equal in value to the solution. Mr. Heywood then proceeded to refer to other artificial tillages, amongst which he spoke of shoddy as a cheap and valuable fertiliser. Shoddy consisted of wool, the refuse of manufactures, and was, indeed, the same as flesh, the whole of the nitrogen it contained being turned into ammonia. Shoddy is exceedingly long in decomposing, hence it was necessary to add a greater quantity than was necessary for the particular crop manured by it. Two cwt. would contain more than a crop of turnips would require, but it would not give it off sufficiently fast, and, therefore, it would be necessary to use more. The following compost would be found exceedingly beneficial, viz.:—1 cwt. of acid, 2 cwt. of bones, 2 cwt. of salt, 1 cwt. of gypsum, 5 cwt. of shoddy. Where the refuse of soap could be obtained it would be found to possess great advantages, but he questioned whether the ammonia given off by this material was equal to the decay of shoddy. Soot applied to wheat was of little advantage, for, although it darkened the blade, it had little effect on the produce. Amongst other vegetable tillages they had rape dust, a substance for which they gave upwards of 5*l* per ton. If they estimated the value of this as being equal to linseed cake, which is about the case, then they would find that the same quantity of phosphates, ammonia, &c., which a ton of this contains could be purchased in guano for 1*l*.

EXPERIMENTS TO DETERMINE THE EFFECT OF BARLEY AND MALT ON THE MILK OF COWS, AND THE FATTENING OF BULLOCKS.*

BY THOMAS THOMSON, M.D. AND R. D. THOMPSON, M.D.

In consequence of applications from farmers to be permitted to malt barley and other grains, without paying excise-duties, in order to fatten cattle, Dr. Thomson, of Glasgow, Mr. Graham, Professor of Chemistry in University College, and Dr. Lyon Playfair, were applied to, for their opinion as to the increased value acquired by grain when malted, for that purpose, and they were generally adverse to the adoption of the plan, which they considered anything but advantageous.

Dr. T. and Dr. R. D. Thomson, instituted a series of experiments, the object of which was to determine what effect the feeding with barley and malt would have on the milk and butter yielded by cows. They obtained two young cows from Ayrshire, of the best breed of milch cows in Scotland; they had calves about six weeks previously, and were supposed to be again in calf. There was a difference of only twenty-seven pounds in the weight of the two. The first series of experiments were made by Dr. Thomas Thomson.

The milk of the cow is a very complicated liquid, for it contains at least ten different substances. It has often been subjected to a chemical analysis in various countries, but the constituents have not been found to vary much.

The following table shows the composition of the French and German cow's milk:—

	French cow.	German cow.
Water	87·02	87·300
Butter	3·13	3·000
Lactosin	4·77	4·338
Casein	4·48	4·779
Soluble salts ..	0·60	0·262
Insoluble salts..		0·321
	100·00	100·000

The first of these analyses was made by O. Henry and Chevalier, the second by Haidlen.

We made several analyses of the milk of both our cows; they agreed pretty nearly with each other.

The constituents of the milk of the brown cow were—

Water	87·20
Butter	3·70
Lactosin	4·35
Casein	4·16
Soluble salts	0·15
Insoluble salts	0·44
	100·000

The constituents of the milk of the white cow were—

Water	87·400
Butter, Lactosin, Casein..	11·898
Soluble salts	0·251
Insoluble salts	0·451
	100·000

The quantity of butter which we obtained in all our analyses somewhat exceeds that in milk of foreign cows, while that of the casein is a little less.

The specific gravity of the brown cow's milk was— 1·0304

Of the whey	1·0315
Of the butter	0·9170

The specific gravity of the white cow's milk was— 1 0309

That of the whey and the butter the same as in the milk of the brown cow.

The soluble salts in milk are

Chlor. of potass.,	from 0·144 to 0·183	per ct.
Chlor. of sodium	0·024 to 0·034	,,
Soda	0·042 to 0·045	,,

The insoluble salts are

Phosphate of lime,	from 0·231 to 0·334	,,
Phos. of magnesia,	0·042 to 0·064	,,
Phosphate of iron	0·007 to 0·007	,,

Butter is an oily substance with which every one is familiar. As employed in this country it always contains some casein and lactosin. It is obtained from the cream or the milk by churning. The temperature ought not to be below 52°, otherwise the process of churning will be tedious. During the churning the temperature rises about 4°. When the cream is above 60° or 70° the time of churning is much diminished, but the quality of the butter is injured.

Butter is composed of three acids; viz., butyric, caproic, and capric, each combined with glycerin.

The composition of these bodies is—

Butyric acid	$C^8\ H^5\ O^3$
Caproic acid	$C^{12}\ H^{11}\ O^3$
Capric acid	$C^{18}\ H^{14}\ O^3$
Glycerin	$C^{46}\ H^{45}\ O^{30}$

Lactosin is the name which modern chemists have given to what was formerly called sugar of milk. It is a white solid substance, having a slightly sweet taste, and soluble in water and alcohol, but not in ether.

Its constituents are—

* *Medical Gazette.*

Carbon	44·44
Hydrogen	6·18
Oxygen	49·38
	100·00

This composition may be represented by the empirical formula—

$$C^{12} H^{10} O^{10}$$

Casein is the substance which constitutes the curd of milk, and of which cheese is made. It is in solution in the milk, but coagulates and becomes insoluble at 212°, forming the film or white coat which covers the surface of boiling milk. It resembles very closely the albumen of blood and of the egg, but differs in the coagulating point. Albumen coagulates at 159°, casein at 212°.

The composition of albumen and casein is nearly the same: it is as follows:—

Carbon	64·767
Hydrogen	8·965
Azote	20·243
Oxygen	5·552
Sulphur	0·473
	100·000

This composition may be represented by the formula—

$$10\,(C^{40} H^{31} Az^{5} O^{12}) + S.$$

$C^{40} H^{31} Az^{5} O^{12}$ is the common constituent of fibrin, albumen, and casein.

We examined the dung repeatedly during the course of the experiments, by drying a given quantity of it at 212°, and determining the solid residue. The chief difference was in its consistency, or in the quantity of water which it contained.

The mean quantity of dung voided by the brown cow in twenty-four hours was 77·064 lbs., and that by the white cow 78·911 lbs. The greatest quantity voided by the brown cow in twenty-four hours was 100·355 lbs., the smallest quantity was 55·44 lbs.; the greatest quantity voided by the white cow in twenty-four hours was 98·859 lbs., the smallest 54·718 lbs.

The dry dung was subjected repeatedly to analysis, and its constitutents were

Carbon	45·74
Hydrogen	5·64
Azote	1·81
Oxygen	46·81
	100·00

As the milk and dung both contain azote, it is evident that the food, or at least some portion of it, must have contained that principle. We examined the different substances given to the cows as food, to discover whence that important principle in the animal economy was obtained.

Now the articles of food were grass, hay, barley, and malt.

The grass and the hay consisted of the stems and leaves of the lolium perenne, or common rye grass.

100 parts of the grass dried at 212° left 31 of dry matter.

100 parts of hay treated in the same way, left 81·05 of dry matter.

This dry residue being subjected to analysis, was found to be composed of

Carbon	45·41
Hydrogen	5·93
Azote	1·84
Oxygen	39·21
Ash	7·61
	100·00

It contains rather more azote than the dung. When the cows were fed with grass alone this surplus in the grass over that in the dung must have gone to the formation of casein in the milk.

100 lbs. of grass contain about 0·46 lbs. of azote.

100 parts of barley, when dried in a heat of 212°, leave 90·54 of dry matter. This dried barley being subjected to analysis, was found to be composed of

Carbon	46·11	$C^{56} H^{48} Az O^{38}$
Hydrogen	6·65	
Azote	1·91	
Oxygen	42·24	
Ash	3·09	
	100·00	

The barley contains rather more azote than than the grass, but not much.

There were slight differences in the quantity of azote obtained from barley in different analyses; the quantities per cent. were as follows:—

1·91 1·95 1·98 2·01.

These differences are so slight that they may be referred to errors in the analyses. The mean of them all is, that 100 parts of dry barley contain 1·96 of azote. If the azote (as is most probable) be a part of the albumen or casein existing in the barley, then 100 parts of dry barley must contain 12·25 of albumen.

Malt is barley made to germinate. During the process a good deal of carbonic acid is evolved, obviously at the expense of the barley. Accordingly the weight of barley is diminished by malting; for 100 barley, when converted into malt, are reduced to 84·78.

100 parts of malt, when dried at 212° till they ceased to lose weight, became 89·9.

Malt, thus dried, being subjected to analysis, was found composed of—

Carbon	44·78		
Hydrogen ..	7·06		
Azote	1·62	1·11 1·19 1·45	
Oxygen	44·76	C^{65} H^{61} Az O^{48}	
Ash	1·77		
	99·99		

Two important consequences follow from this analysis. The first is that the quantity of azote in barley is diminished by converting it into malt. Barley contains very nearly two per cent. of that principle; while the mean of four analyses gives 1½ for the quantity of azote in 100 parts of malt. The second consequence from these analyses is, that the quantity of azote in malt is much more variable than in barley. In barley the two extremes approach very near each other, being 1·91 and 2·01; in malt they are 1·11 and 1·62. In the barley the variation amounted to only five per cent., and might be considered as owing to errors in the experiments; but in the malt the variation was 46 per cent., an error too great to be committed by the most careless experimenter.

Malt, then, differs in its composition more than barley. This difference is most likely owing to the process of malting being carried further in some malt than in others. The azote in malt is less than in barley, and doubtlessly it is least in the barley that has been malted to the greatest degree.

During the process of malting, the starch of the barley is partly converted into starch-sugar. But besides the starch-sugar, malt obviously contains other constituents; for the composition of starch-sugar is

Carbon.....	36·20	
Hydrogen	7·09	C^{12} H^{14} O^{14}
Oxygen	56·71	
	100·00	

Malt contains less carbon than barley, but a great deal more than starch-sugar. It contains less azote than barley, but starch-sugar contains none at all.

There are two reasons why malt is less nutritive than barley.

1. When 100 parts of barley are malted, the weight is reduced to 87·39, or it loses 12·61 of its weight; 100 parts of barley must be represented 87·39 of malt, and unless 87·39 of malt went as far as 100 of barley in feeding cattle, it could not be said that malt is as nourishing as barley. Now it will be seen, from the experiments which we have made, that this is not the case.

2. Malt contains less azote than barley. Now azote enters as an essential constituent into milk. It constitutes also an essential constituent in the fleshy parts of cattle, and indeed in almost every part. Hence, unless it be supplied in sufficient quantity by the food, neither the milk can be brought to the requisite state of perfection by the processes of digestion, nor can the daily waste of the system be properly repaired. So true is this that the quantity of nourishment in food may, in most cases, be estimated by the quantity of azote which it contains. Wheat is the most nourishing of all the cerealia, and it contains the most azote.

It will be proper to give here three different analyses of malt, to show that it varies in its other constituents as well as in its azote:—

Carbon ..	49·93	44·780	42·44
Hydrogen	7·00	7·060	6·64
Azote ..	1·50	1·620	1·11
Oxygen..	46·30	44·763	43·08
Ash	1·27	1·777	1·68
	100·00	100·000	94·95
			5·05 Water
			100·00 Total.

100 parts of the ashes of malt, being subjected to analysis, we found composed of the following ingredients:—

Silica	28·74
Phosphoric acid	38·34
Chlorine	trace
Peroxide of iron	1·59
Lime	3·89
Magnesia.....	9·82
Potash.....	11·72
Soda	5·60
	100·00

The first set of experiments which were continued for a fortnight, consisted in feeding the cows on cut grass, while confined in a byre. With the brown cow, the average quantity of grass consumed during the fortnight was 101·91 lbs. per day = 31·58 of grass dried at the temperature of 212°.

The average milk per day was 24·604 lbs. = 3·1517 lbs. of dried milk.

The average dung per day was 74·93 lbs. = 8·744 lbs. of dry dung. We found that 100 of the dung when dried at 212°, left 11·67 of dry matter.

Thus we have		lbs.
Average food, dry.....		31·3800
Average milk ..	3·1517	11·8957
Average dung ..	8·7440	
Excess of food above egesta		19·4843

The average quantity of cream during each of these fourteen days was 5·34 per cent. of the bulk of the milk. It was estimated by putting the milk into a tall glass dish graduated, and allowing it to remain at rest for

twelve hours. But it was found on trial that to be sure of the separation of the whole cream, the milk required to be left at rest for forty-eight hours. This method was practised from the 9th of July to the end of the experiments.

The butter during these fourteen days amounted to 10·28 lbs., or 0·735 lb. per day.

With the white cow.

	lbs.	lbs. dry.	lbs.
Aver. grass per day	109·91	= 31·58	31·590
Aver. milk per day	21·868	= 2·799	11·129
Aver. dung per day	71·460	= 8·330	
Excess of egesta above food			20·451

The average cream per day, measured in the same way as the cream of the brown cow, was 5·82 per cent., or rather more than that from the brown cow. But for the reason already assigned, this estimate must be considered as below the truth.

The butter which the milk yielded during these fourteen days was 7·23 lbs., or 0·516 lb. per day. This is considerably less than that yielded by the brown cow during the same time.

In the next experiments, a mash of barley was substituted for an equivalent portion of the grass; the experiment was continued for eleven days; the results was as follows:—

1.—The brown cow.

	lbs.	lbs. dry.	lbs.
Aver. grass per day	85·45	= 26·489	30·264
Aver. barley per day	4·32	= 3·775	
Aver. milk per day	20·42	= 2·615	12·511
Aver. dung per day	75·92	= 9·896	
Excess of food over egesta			17·753

2.—The white cow.

	lbs.	lbs. dry.	lbs.
Aver. grass per day	85·45	= 26·489	30·264
Aver. barley per day	4·32	= 3·775	
Aver. milk per day	20·108	= 2·615	13·099
Aver. dung per day	80·650	= 19·484	
Excess of food over egesta			17·165

In the third experiment malt was given for ten days instead of the barley and in larger proportions; the results were—

1.—Brown cow.

	lbs.	lbs. dry.	lbs.
Aver. grass per day	85·0	= 26·350	31·356
Aver. malt per day	5·6	= 5·006	
Aver. milk per day	19·341	= 2·477	12·550
Aver. dung per day	75·301	= 10·083	
Food exceeded the egesta by			18·796

2.—White cow.

	lbs.	lbs. dry.	lbs.
Aver. grass per day	85·	= 26·350	31·356
Aver. malt per day	5·6	= 5·006	
Aver. milk per day	20·417	= 2·613	14·330
Aver. dung per day	84·296	= 11·717	
Excess of food above egesta			17·026

The fourth and fifth sets of experiments were made with barley, hay, and grass, and the results showed that when fed on barley, the cows yielded considerably more butter and milk than when fed on malt. In the sixth, molasses were given with the barley and hay, and the results were—

1.—Brown cow.

	lbs.	lbs. dry.	lbs.
Hay per day ..	27·19	= 22·037	32·902
Barley per day..	9·000	= 7·865	
Molasses per day	3·000	= 3·000	
Milk per day ..	20·558	= 2·822	12·973
Dung per day ..	85·22	= 10·151	
Excess of food above egesta ..			19·929

2.—White cow.

	lbs.	lbs. dry.	lbs.
Hay per day ..	27·000	= 21·883	32·748
Barley per day..	9·000	= 7·865	
Molasses per day	3·000	= 3·000	
Milk per day ..	22·703	= 2·906	14·751
Dung per day ..	87·750	= 11·845	
Excess of food above egesta....			17·997

With the brown cow there was a considerable falling off, both in the milk and butter, and with the white, an increase in the milk, but a diminution in the butter; the two experiments which were continued for nine days, are not in favour of the nourishing qualities of molasses, as food for cattle.

In the seventh set of experiments, which were continued for sixteen days, malt was substituted for barley, and given freely, beginning with six pounds a-day, soon raised to nine pounds, and to twelve pounds daily for the last nine days.

1.—Brown cow.

	lbs.	lbs. dry.	lbs.
Hay per day ..	25·87	= 20·967	30·533
Malt per day ..	10·70	= 9·566	
Milk per day ..	19·93	= 2·525	12·961
Dung per day ..	76·49	= 10·436	
Excess of food above egesta ..			17·572

2.—White cow.

	lbs.	lbs. dry.	lbs.
Hay per day ..	29·38	=23 812	33·378
Malt per day ..	10·70	= 9·566	
Milk per day ..	21·585	= 2·761	13·385
Dung per day ..	78·701	=10·624	
Excess of food above egesta ..			19·993

With both the animals in this experiment, there was a considerable diminution in the milk and butter. In the next experiment, barley was again substituted for the malt, and with both cows there was a diminution in the quantity of milk and butter, but not so much as in the preceding experiment.

Feeding the cows with three pounds of linseed-meal daily, in addition to thirty pounds of hay and nine of barley, gave with the brown cow an increase in the milk amounting to 4·5 per cent., and in the butter to 9 per cent.; in the white cow, the increase of milk was not quite 1 per cent., whilst that of the butter was above 30 per cent. The experiment was thought so promising, that it was repeated, the quantity of linseed being increased to six pounds, and the barley proportionably reduced. The result was, that with the brown cow the milk exceeded that of the last experiment by 2·6 per cent., and was 7·3 per cent. more than when the cow was fed with barley and hay alone; but the butter was 6·8 per cent. less than in preceding experiment, and only 2 per cent. more than in experiment eight, in which no linseed was given.

With the white cow, the milk exceeded that in the previous experiment by 2·8 per cent. It exceeded that of experiment eight, when barley only was given, by 3·6 per cent. The butter was less than in the previous experiment, but more than in experiment eight.

These experiments were not, perhaps, continued long enough to give decisive results, but they are in favour of the prevailing opinion, that linseed promotes both the quantity of milk and butter of cows.

In the eleventh experiment bean-meal was substituted for the linseed-meal, with the result of diminution in both cows of about 6 per cent. of the milk, and a slight increase in the quantity of butter, as compared with the yield under the linseed regimen.

The result of these experiments is given in the following tables:—

Brown cow.

	Milk. lbs.	Butter. lbs.
I. Grass	26·604	0·735
II. Barley....	20·420	0·7075
III. Malt	19·341	0·6332
IV. Barley ..	22·610	—
V. Barley ..	23·187	0·791
VI. Molasses..	20·558	0·730
VII. Malt	19·710	0 682
VIII. Barley ..	19·396	0·675
IX. Linseed ..	20·280	0·734
X. Linseed ..	20·184	0·687
XI. Bean-meal.	19·590	0·755

White cow.

	Milk. lbs.	Butter. lbs.
I. Grass	21·868	0·516
II. Barley ..	20·108	0·555
III. Malt	20·417	0·6749
IV. Barley ..	22·000	0·790
V. Barley ..	21·763	0·678
VI. Molasses..	22·703	0·654
VII. Malt	21·585	0·591
VIII. Barley ..	20·088	0·565
IX. Linseed ..	20·244	0·741
X. Linseed ..	20 814	0·682
XI. Bean-meal.	19·582	0·755

They leave no doubt that barley is more nourishing to cows than malt; at least, as far as the production of milk and butter is concerned. And they confirm the conclusions which were drawn from the chemical analysis of both. Barley, when malted, loses almost one-fifth of its weight. The proportion of azote (which is necessary both for the support of the animal and for the production of milk) is considerably less in malt than in barley.

The second report, on the relative value of grass, barley, malt, molasses, linseed, and bean-meal, as food for cows, proceeds from the pen of Dr. R. D. Thomson. The experiments which he conducted appear to have been made with the same cows as those employed by Dr. T. Thomson. The average quantity of milk yielded by the white cow, when at pasture, was stated to be 10 quarts, or about 25 lbs. 12 oz. imperial weight. The brown cow under the same circumstances yielded rather less milk, but more butter than the white one.

The cows were very different in reference to their nervous condition. The white cow was quiet and steady, generally eating equal portions, and producing equable quantities of milk. The brown cow, on the contrary, was fitful in her appetite, and of consequence was variable in the amount of her products. In proportion to her weight she consumed a larger amount of food than her fellow, but always afforded less milk and a greater amount of butter. The variable action of her organs is well exhibited in the first series of tables. When at pasture she had given two pints less than the white cow, and immediately before the experiments she gave

the same quantity as her fellow. On her arrival in Glasgow her milk greatly increased, but it soon began to diminish, although the same amount of food was continued. That the change was not produced by any alteration in the food is obvious from the steadier result afforded by the white cow, which was also supplied with an equal weight of fodder. The amount of milk given by the brown cow was as much as 26 lbs. per day when she was fed with grass, and upon the same kind of food the quantity declined to 22 lbs.; while the milk produced by the white cow was, at the commencement of the experiment with grass, 23 lbs.; and at the termination of the trial, 21 lbs.; so that there was a falling off, in the case of the brown cow, to the extent of 4 lbs., and with the white cow only to the amount of 2 lbs. That this result was not merely owing to a deficiency of water was proved by experiment, which gave the same amount of water in the milk of both cows; but the quantity of butter afforded by the brown cow amounted to 11¼ lbs., while that of the white cow was 8⅛ lbs., in fourteen days, from 1,427 lbs of grass supplied to each animal. Again, when the animals were fed on steeped, entire barley, the brown cow's milk fell from 22½ lbs. to 17½ lbs., while that of the white cow's only declined from 22 lbs. to 19½ lbs.; the brown cow falling off to the extent of 5 lbs., and the white cow only to the extent of 2½ lbs. These facts are sufficient to show that the two animals were constitutionally different. The occasional wild look of the brown cow, her tendency to gore those who approached her, her frequent startled aspect, all indicated a nervous state of excitement; the probable cause of which has been already alluded to. The result of these experiments seem to countenance the idea that, although a handsome external figure is not necessarily an indication of the highest capacity in a cow to produce milk and butter, yet that it may conduce to afford a steady supply of milk, inasmuch as it appears to indicate a proper relation between the organs.

The first set of experiments were conducted to ascertain the influence of grass in the production of milk and butter; the animals were fed on rye grass (lolium perenne,) and it was found that 100 lbs. of dry grass produced 11·6 lbs. of dry milk, 33·6 of dung, and 2·71 lbs. of butter.

From these experiments it therefore appears that the same quantity of food given to cows nearly of the same weight, produced 5 lbs. less of solid matter of milk in one cow than the other; 100 lbs of solid matter of grass producing in the brown cow 17½ lbs. of dry milk, and in the white cow only 15½ lbs. It appears, however, that both cows were increasing in weight; but, as the white cow advanced most rapidly, it is probable that the difference in the quantity of solid milk may have been applied to increase the weight of the white cow. There is another alternative which is also admissible—viz., that the capacity of the lungs and respiratory organs of the white cow were greater than those of the brown cow, since the former absorbed a greater amount of solid matter from the grass, as appears from the difference between the grass and dung, than in the case of the brown cow. These important differences in the two animals rendered it impracticable to make comparative experiments upon them at the same time. The only method which could afford results of value was to supply each with the same kind of food, and thus to obtain data which could enable a judgment to be formed as to the relative nature of the constitutions of the animals.

The succeeding experiments consequently were parallel and not comparative sets with the two animals.

While these experiments were being carried on by Dr. R. D. Thomson, other matters more relatively connected with the subject were not forgotten. The constituents of the food which supplies the butter for instance, were examined into. On this point he says:—

It is now upwards of a century since Beccaria of Bologna broached the idea that animals are composed of the same substances which they employ as food: "En effet, si l'on excepte la partie spirituelle et immortelle de notre être, et si nous ne considerons que le corps, sommes nous composès d'autres substances que de celles qui nous servent de nourriture?" (1742.) Collection Academique, tome x. p. 1. In more recent times Dr. Prout has defended the same doctrine, and has referred us to milk as the type of nourishment. In this fluid the main solid constituents are oil, fibrin, and sugar; these, therefore, or analagous bodies he considers should enter into the composition of all wholesome nutriment. Still more lately a difference of opinion has resulted with reference to the exact part which starch or sugar plays in the animal economy. Fibrinous matters, it is generally admitted, undergo little or no alteration in the system; but whether it is necessary, in order to produce fat in an animal, that the food should contain oil, and that no other form of nutriment can produce this substance, is a question which has been very much debated. A French chemist, Boussingault, contends that the presence of oil, if not essential in the food, is at least very important in increasing the amount of fat deposited; while Liebig holds,

that oil may possibly be assimilated or converted into butter, but that the same product may result from the deoxidation of starch or sugar in the animal economy. To the agriculturist, the settlement of this question is of no small importance, since it may guide him in the use of various kinds of food for the fattening of cattle, which may otherwise be overlooked, and may also conduce to the proper preparation of food—a subject which has received less attention than perhaps it deserves. In the prosecution of the present series of experiments, the prospect of throwing some light upon this interesting subject has been kept in view, and, in general, such experiments as were required to afford data for calculating from different kinds of food, the probable origin of the oily matter secreted by the animals have been carefully registered. To solve the question, it is necessary to ascertain the amount of oil in the food. The oily matter in the grass was determined by first drying the grass at a temperature of 212°, to remove water: it was then digested in successive portions of ether, until that liquid ceased to remove any matter in solution. The same experiment was performed with the dung. The first process, therefore, gave all the oily matter swallowed by the animal, and the second afforded the oil or wax which was not taken into the system; 2000 grains of grass when dried became 500 grains. By digestion in ether 42·3 grains were taken up of a matter having a dry waxy consistence, possessing a green colour, but without any of the characters of a fluid oil; this is equal to 2·01 per cent. 4,284 grains of moist dung from grass, equivalent to 500 grains of dry dung, afforded 13·2 grains of an exactly similar green waxy matter to that found in the grass, equal to 0·312 per cent. The largest amount of wax in the dung of the cattle was obtained while they were feeding on hay; 1,000 grains of dung left, at the temperature of 212°, 157 grains of dry dung, which gave 6 grains of wax, equivalent to 0·6 per cent. in moist dung, or 3·82 per cent. in the dry dung. All these products were carefully dried for some days at the temperature of boiling water. From these data, then, we are enabled to construct the following table:—

Amount of oil and wax in food of both cows in fourteen days ..	57·3 lbs.
Amount of oil or wax in dung ..	6·3
Amount of oil or wax consumed by the cows	51·0
Amount of dry butter	16·7
Excess of oil or wax in the food	34·3

To ascertain whether the whole of the butter is removed from the milk by the usual process of churning, portions of the same milk were analysed by the usual methods for the sake of comparison. The brown cow's milk in the present experiment contained 3·46 per cent. of butter, while, by analysis, the amount was 3·7, making a difference of rather less than a quarter of a pound in 100 pounds of milk. This is so small that it does not effect the preceding calculation, but rather tends to show that the determination of such questions on a large scale is preferable to the usual analytic methods, since the analysis of milk twice a day for several months would be such a laborious work as to render its accomplishment impossible.

It is necessary to explain the circumstance that butter, as obtained by the usual mechanical process, contains foreign matter, consisting of water and curd or casein. By analysis, butter was found to have the following composition:—

Casein	0·94
Oil	86·27
Water	12·79

The composition of French butter has been stated to be somewhat different, as it has been found to contain upwards of eighteen per cent. of impurity. This may be owing to the coldness of the summer during which the present experiments were made.

The hardness of the butter was a subject of general remark, and might render it better fitted for being freed from casein than if it had possessed a more fluid form.

The cause of tainting of fresh butter depends upon the presence of the small quantity of acid and water as exhibited by the preceding analysis. To render butter capable of being kept for any length of time in a fresh condition, that is, as a pure solid oil, all that is necessary is to boil it in a pan till the water is removed, which is marked by the cessation of violent ebullition; by allowing the liquid oil to stand for a little while the curd subsides, and the oil may then be poured off, or it may be strained through calico or muslin, into a bottle, and corked up. When it is to be used it may be gently heated and poured out of the bottle, or cut out by means of a knife or cheese gouge. This is the usual method of preserving butter in India (ghee) and also on the Continent, and it is rather remarkable that it is not in general use in this country. Bottled butter will thus keep for any length of time, and is the best form of this substance to use for sauces.

From the preceding table it appears that the oil consumed by the cows greatly exceeded the butter, and the oil contained in

the dung, even if the casein and the water were not subtracted from the butter; the total quantity of butter being 19lbs. 6oz. The result of this experiment is in perfect accordance with the facts observed by Boussingault, who, in similar researches upon cattle, found the oil in the food to exceed that in the dung and milk. The matter extracted by ether from grass, however, can scarcely be termed an oil, since it possesses all the characters of a wax; that is, a body which contains a smaller amount of oxygen than the fat oil—certainly less than is contained in butter. It is therefore difficult to conceive a wax to obtain more oxygen in the system and to be converted into an oil, where all the actions are calculated to remove oxygen, and not to supply it; such an occurrence would be as probable as the addition of oxygen to wood by throwing it into the furnace. The production of butter from sugar by the action of casein or curd is, on the contrary, a process with which chemists are now familiar, and is therefore more readily admissible into physiological theories than the idea of the formation of butter from wax, since we are unacquainted with any analogous example. The connexion between sugar, oil, and wax is exhibited by the following formula.

	Carb.	Hyd.	Oxyg.	Differences.		
				Carb.	Hyd.	Ozgy.
Sugar	48	44	44			
Fat	44	40	4	4	4	40
Wax	40	40	2	4	0	2

In bees we have a well demonstrated example of the production of wax from sugar, while fat, or the intermediate stage, is probably first produced in the body of the bee, and is then, by the loss of a small portion of carbon and oxygen, converted into wax, or to the lowest state of oxidation existing in the animal system. The point, therefore, to which it is necessary to direct attention is, that we have instances in chemical physiology of substances being produced from the others preceding it in the table, but that we are unacquainted with any phenomena of an inverse order; nor would such an occurrence be explicable upon the principles on which the animal system is understood to proceed. Taking all these circumstances into consideration, it appears that there are fewer difficulties in the way of supposing that butter is formed from the starch and sugar of the food, than from the waxy matter which is present in such considerable quantities. There is only one instance, with which physiologists are at present acquainted, that could be adduced as evidence in favour of any substance being rendered more complex in the animal system, viz., the production of fibrin or flesh from curd or casein. So far as chemical experiments carry us we are not in a condition to affirm that no fibrin exists in milk, but it is admitted that none has as yet been detected. If these be correct, then it would appear to follow that the infant fed on milk must derive its flesh from the curd of that fluid, and that as curd contains no phosphorus (while fibrin does) the curd of the milk, in order to form muscular fibre, is united to phosphorus in the animal system, and is thus built up, instead of being, as is the rule with other substances, reduced to a smaller number of elements. The composition of the two substances is as follows:—

Casein or Curd.

Carbon.	Hyd.	Oxygen.	Nitro.	Sulph.	Phos.
54·96	7·15	21·73	15·80	0·36	—

Animal Fibrin.

54·56	6·90	22·13	15·72	0·33	0·36

The objection to this view of the subject is that the experiments which have been made on fibrin do not prove that it contains phosphorus; they only prove that phophoric acid can be detected in it, even when it is purified in the most careful manner suggested by chemical knowledge; and it would therefore the somewhat premature to adopt any such analogy as that which we have been considering.

(*To be continued.*)

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE ACTION OF HYDROCYANIC ACID AS A POISON.*

BY DR. MEYER.

The Doctor states as the result of his experiments with this acid on animals—

"1. That it had a paralyzing action on the peripheric nerves—*i. e.* it suppressed sensation and motion, and occasioned congestion, with augmented secretion, which was chiefly observed in the cavity of the mouth. 2. He found it to act only when received into the vascular system. On mechanically arresting the circulation, the poison did not act, although the integrity of the nervous system was preserved. On restoring the circulation, the operation of the poison was immediately observed. 3. Hydrocyanic acid does not act so rapidly as it was formerly believed. Its operation was never instantaneous. 4. Its fatal effect is owing to paralysis of the heart induced by the topical action of the blood, mixed with hydrocyanic acid, upon that organ. It required about thirty seconds for the poisoned blood to reach the heart and produce its paralysing effects, and it mattered not whether the poison was applied directly to the substance of the heart, or to parts remote from it. In Dr. Meyer's opinion, prussic acid may act independently of the brain or nerves, or of their intervention. It requires for its operation, absorption and diffusion until it reaches the heart. It is owing to this, in his opinion, that amphibia are less rapidly killed by this poison than mammalia, the action of the heart in those animals being less necessary for the maintenance of life. Nevertheless, in a certain dose the poison may act upon and paralyze the nervous system, producing tetanic convulsions, congestion of the veins, and exudations in the serous cavities. It is not true, as it is generally believed, that in death from prussic acid the blood does not coagulate. Dr. Meyer found that this liquid coagulated in the bodies of the animals which were killed in his experiments."—*British and Foreign Review.*

These observations are to a certain extent confirmed by an experiment of Liebig. He endeavours to prove that prussic acid does not act by sympathy through the nervous system, nor is it absorbed directly into the blood; but that it can only act through the medium of its vapour on the pulmonary mucous membrane. If this statement be correct, it may be made to act as a poison, and yet with difficulty be discovered after death.

* *Lancet.*

NOVEL APPLICATION OF HYDROCHLORATE OF MORPHINE.*

BY M. EHRARD.

It is well known that all kinds of neuralgia, and more particularly odontalgia, are very difficult of cure, although they may be considerably modified by means of preparations of opium, and particularly hydrochlorate of morphine. M. Ehrard believes, that if this last substance is not more efficacious, it is because it is not properly administered.

In fact, hydrochlorate of morphine, according to M. Ehrard, should be applied to the gums by friction on the affected side. M. Ehrard asserts that this simple change in the mode of application will, in a short time, remove the most afflicting toothache.

The author makes several observations which appear to be decisive. It is particularly in the case of those who are feeble, delicate, and extremely nervous that this mode of treatment is successful, and in many cases the pain arising from carious teeth has disappeared as if by enchantment.

The following is the mode of proceeding adopted by M. Ehrard:—

The first day the patient takes 13 milligrammes of the medicament on one of his fingers, previously wetted, and he rubs the affected gum with it for the space of three minutes, he then holds his head on one side, taking care neither to spit nor swallow, to give time for the absorption of the salt; and afterwards he swallows his saliva.

At the end of two hours the operation is to be repeated.

On the following day, if the disease continues, we increase the dose, if necessary, to 37 milligrammes.

In frontal neuralgia, M. Ehrard employed hydrochlorate of morphine with the most marked success, by applying it to the mucous lining of the nostrils.

* *Journal de Chirurgie.*

THE ISLAND OF CHUSAN, CHINA.—ON THE EFFECTS OF THE CLIMATE ON EUROPEAN CONSTITUTIONS.*

BY FRANCIS DELAVAL WALSH, ESQ.

HAVING resided some time on the coast of China, I forward these few remarks on a peculiar disease that prevails there, and afflicts nearly all Europeans that newly arrive; I may safely say, that out of a thousand that went down the coast as far as Chusan during the late war, not one escaped. I mention this as the average. Those who had been there previously, promised us that we should all certainly be sick as soon as we set foot on the coast of China, though we had never been sick before. It happened so; I was sick there for the first time since I had been out; so were all that were with me, soldiers and sailors. No sooner were we anchored in Chusan harbour, than we were seized with pains in the bowels, and loss of appetite. Some vomited, and all had diarrhœa; nothing that we ate agreed with us, though we tried all sorts of food. The soldiers on shore were nearly all in hospital; in one company there were only two men able to do duty. The same disease attacked all the officers. It was a common occurrence to see thirty or forty officers sit down to dinner, and then jump up and run out as soon as they had swallowed the first spoonful of soup; so that they used to call the disease the Chusan trot. It was called the main-deck trot by the sailors. Some soon recovered, but were very apt to relapse upon the least change of weather, as, for instance, a shower of rain. Dr. P. Grant, who inspected the hospital at Chusan, said it was the most troublesome disease he ever had to deal with. The men kept leaving the hospital, and returning again, at every relapse losing flesh, and becoming weaker, until they were quite worn out, and many died.

This disease, though troublesome and fatal, could be easily relieved. Anything that excited a secretion of bile gave temporary relief. It seemed that the liver had refused to secrete bile, or act, and yet did not become inflamed or congested, but torpid or inactive. The circulation through the portal vein was diminished; the intestines were congested; the stools liquid, frothy, and clay-coloured, something like brewer's yeast in appearance—sometimes mixed with undigested food lately taken. If by means of calomel or blue pill we could excite the secretion of bile, the disease was relieved for a time. Some were so conscious of this, that they took small quantities of blue pill every day. I preferred fasting, and believe I cured myself by that means; but I could persuade few to adopt this remedy; they preferred eating, drinking, smoking, and blue pill. I have heard no one assign any probable cause for this disease; some attribute it to bad air, and some to bad water; some thought that the Chinese had poisoned the springs, but we found no change when we drank Thames or Indian water from the ships, and we saw nothing that could produce malaria. There was no sea-beach, swamp, or uncultivated land. The coast was hills and rocks. The rice-grounds were few and small, and no change was observed, either when they were covered with water or drained.

I have attributed this disease to a certain electric state of the locality. The following will be my reason for doing so:—

The coast of China is the eastern coast of the largest tract of land in the world—of the great eastern continent, extending in longitude from the east of China to the west of Africa. It is also bounded by the largest tract of water—the great Pacific Ocean.

Now, there is a current of electricity passing round the world from west to east, (see Faraday); and electricity is conducted better by water than by land. Electricity, then, will be positive on the western, and negative on the eastern coast; or on the one it will be plus, and on the other minus. Now we have pretty good proof, that where electricity is negative, vitality is depressed; where it is positive, it is excited. The hand placed in the negative current, becomes cold, in the positive, warm; and many practitioners in India have remarked, that there are peculiar diseases in connection with peculiar electric states of any locality; that there is a remarkable difference in the biliary secretion; the liver is excited where the electricity is positive, depressed where it is negative. Now, in diseases on the coast of Africa, the practitioners complain of excess in the secretion of bile; on the coast of China, of deficiency. In the diseases of China, there was a complaint that no bile was secreted. This is directly the reverse of the diseases on the coast of Africa: an excess of the action of the liver is complained of in the same latitude with the same heat of climate. Bleeding is more resorted to on the coast of Africa, and calomel in large doses, to act as a sedative. In China, bleeding was seldom resorted to with good effects; and calomel was found beneficial in small doses, to act as an excitant. From these reflections, I question if the coast of China will ever be a healthy place, either for Europeans or for natives of India: both seem equally to suffer from disease.

* *Lancet.*

Men are more local beings than they are apt to be aware of; and nature seems to have formed peculiar races of men for peculiar localities. On the eastern coast of the great continent, the men are all Mongolian; on the western, they are a directly opposite race. There, the African becomes the strongest amongst the human race—there, the European cannot live and generate.

I may offer a few remarks on the great diffesence between the African and Mongolian race. If we take the same latitude, the same heat of climate—the tropic of Cancer, for instance—we find on the eastern coast the race is fair; where protected from the sun, they are of waxy-white complexions. Some of them appeared as much whiter than our Europeans as the Europeans were whiter than natives, of which I could give instances. The eye is generally angular—the caruncula is always hidden by the upper eyelid. I found no exception to this in a true Chinaman. Every hair of the head, beard, eyelashes, and eyebrows, is straight; the eyelashes hang downwards to the eye; the beard is scanty and straight, and confined to the upper lip and chin; scarcely any of what is called whiskers by us grows on the cheeks and throat. The men appear deficient in virility: they often marry many wives, but have few children. Early marriages are encouraged, to keep up the population. They appear to resemble those Scythians mentioned by Hippocrates, amongst whom there where many natural eunuchs. One of the reasons they give for smoking opium is, to excite sexual desire, or the "golden passion," as they call it.

These peculiarities of the Mongolian race are directly opposite to those of the African. The African is black in the same latitude that the Chinaman is deadly pale; his every hair is curled—his eyes are full—his caruncula is exposed—his beard, more on the throat and cheeks, and less on the lips and chin, is bushy and curled. The men have excess of virility; they are stronger. We find them a match for the English pugilist. Whilst we have these extremes on the eastern and western coasts, we find the centre of the continent occupied by the Caucasian feature, varying in colour with the latitude. As a proof that there is some cause for this, we find that races change their colour and feature, in a few generations after they have changed their localities. The Portuguese at Calcutta and Madras are many of them blacker than the natives, though of white origin. At Macao, the same race are assuming the Chinese features, although they boast of a pure descent; yet, after a few generations, they have straight hair, angular eyes, beard confined to the lips and chin, and pale-yellow waxy-looking complexions. If, according to a late learned writer, the more or less activity of the biliary organs is the cause of the dark or fair complexion, the biliary secretions are certainly deficient on the whole eastern coast of the eastern continent, and in excess on the western coast. Longitude, as well as latitude, seems to effect us in disease. Electricity, as well as heat, has its peculiar effect on the constitution; both, in excess, appear to be excitants. I may add, that I do not believe positive and negative electricity to be proper terms. It is as improper to call a deficiency of electricity negative, as to call cold negative heat. Electricity, like heat, is everywhere seeking equilibrium, but appears to find this equilibrium with greater rapidity.

STOPPING FOR THE TEETH.*

BY M. BERNOTH, OF WARASDIN.

℞ Powdered mastic.. 90 grammes.
Sulphuric ether. .. 40 ,,

Digest for several days, strain it through a cloth, then add native alum in fine powder, in sufficient quantity to form a plastic mass, with which small phials, holding 8 grammes, are to be filled, having first poured into each

Camphorated alcohol 2 grammes.
Essence of cloves... 1 gramme.

This stopping introduced into the cavity of a carious tooth, first well cleaned and dried, is extremely useful on account of the great degree of hardness it acquires.

A NEW MODE OF PRESERVING ANIMAL SUBSTANCES.*

BY THE ABBÉ BALDAUMIK.

The Abbé Baldaumik, preparator at the Museum of Natural History at Vienna, has succeeded in rendering animal substances as hard as stone. To effect this he immerses them in water, holding in solution bichloride of mercury and hydrochlorate of ammonia. Substances that have remained immersed in this liquid for some time acquire the hardness of stone, may be polished, resist the hammer, have an angular fracture, and give out a metallic sound when struck. They preserve their natural colour, and require no further care after they are taken out of the bath.

*Archiv. de Pharmacie.
† Journal de Chimie.

ON THE EXAMINATION OF BALSAM OF COPAIBA.*

BY M. OBERDOFFER.

BALSAM of copaiba has latterly produced considerable embarrassment among druggists with respect to the necessity of its being completely soluble in alcohol. We have often heard the importers declare, that they would no longer deal in this article, unless some new mode of examining it was resorted to. This circumstance induced me, at the request of a respectable mercantile house in Hamburgh, carefully to study the subject again.

If we compare the different kinds of balsam of copaiba, which are met with in commerce, both old and new samples, we shall find a well-marked difference. Formerly, we usually obtained a perfectly transparent balsam, thick, and completely soluble in alcohol, forming a transparent soap with caustic potash, and leaving behind a brittle resin after having been boiled a long time in water. It was seldom met with in a more fluid state, frequently it was more firm in its consistence, more thickened by age, and when agitated with a solution of caustic potash, the latter caused the separation of a transparent soap, with greater difficulty, and only after the lapse of several days. It was sometimes even necessary to employ a slight degree of heat, so that it has frequently been looked upon as adulterated, notwithstanding its complete solubility in alcohol. This last idea originated at a time when balsam of copaiba was at a high price, and, as old castor oil was to be obtained at a much cheaper rate, it was frequently employed to adulterate the balsam. This adulteration only became manifest by the semi-fluid residuum left behind, after the evaporation of the pure essential oil, and the pure thickened balsam, considered as adulterated by a mixture of castor oil, was that alone which justified the suspicion, by this method.

Latterly, the balsam, principally brought from Mexico and the West Indies, frequently appears in commerce in a very fluid state, and occasions the complaints in question. The cause of this difference can only be attributed to its being newer, or less dense, or to adulteration, but in most cases to the first of these causes.

M. Gerber, in 1829, examined various specimens of balsam of copaiba; he found—

	Recent balsam.	Old balsam.
Essential oil	41·00	31·70
Hard yellow resin	51·38	53·68
Soft brown resin	2·18	11·13
Water and loss	5·44	4·10

M. Stockhardt, last year, directed our attention to an extremely liquid balsam which had all the appearance of good balsam; two specimens of which, obtained from different sources, left, after the complete evaporation of the essential oil, the one 42, the other 43·5 of brittle yellow resin: while, according to M. Gerber, the recent balsam yielded 53·38, and the old sample 64·78 of dry resin. A fluid balsam, whose properties I am now studying, only left, after having been boiled a sufficient time in water, 40 per cent. of a brittle and perfectly dry resin.

Having been, for a length of time, accustomed to a thick balsam, we receive less favourably a liquid balsam, which is also not so well adapted to the preparation of pills, for which purpose it is at present most frequently employed, along with wax or calcined magnesia; and to this we must add another circumstance, namely, that the liquid balsam usually produces a clouded mixture with pure alcohol, and thus, according to the rule laid down in the Pharmacopœia, which usually requires complete solution in this liquid, it has been declared impure.

The complaints of the druggists have been sufficiently numerous and well-founded to render it necessary once more to examine the action of alcohol on the liquid balsam.

Comparative analysis has shown a difference of from 32 to 54 per cent. in the proportions of the essential oil, and looking at it in this light, if the fluidity only depends on this circumstance, the liquid balsam may be considered as more active than that which is thickened.

If we except the trial by prolonged ebullition, or by the evaporation of the suspected balsam, in which case the brittle resin that remains is the only certain proof of the absence of a mixture of the fat castor oil, any other isolated trial by reaction is seldom sufficient for a preliminary proof. So that how good soever the plan of agitating it with a solution of caustic alkali may be, the age of the balsam and the amount of agitation contribute to the more or less rapid and complete separation of the transparent soap. Small variations, which in the case of the thick balsam, particularly, may easily be the cause of mistakes as to the purity of the balsam. But the action of alcohol is also insufficient, because it gives no proof of the presence of castor oil, and small quantities of fat oils may even escape detection.

In addition to this, a great variety of samples of balsam of copaiba introduced into the market (not all) also produce a clouded mixture with pure alcohol, without our being able to consider them as impure. Still there is always this difference between this effect

* *Journal de Pharmacie*, June, 1846.

and that produced by fat oils, in this case the mixture, which first becomes rather milky, by agitating it, immediately allows the separation of light flakes, which at first float on the surface and afterwards are deposited at the bottom of the vessel, becoming hard by degrees, but still in small quantity, in comparison with the balsam examined; after their separation by filtration, and being well washed with alcohol, they remain, under the form of a white, dry, and very brittle substance.

It is insoluble both in hot and cold alcohol, ether, and water, but it is readily and completely dissolved in petrolium. It easily melts when heated, and forms a yellowish-white resinous mass, which, on the application of more heat in a platinum spoon, becomes brown and burns, giving out a smell of caoutchouc and a clear flame, and leaving no residue. This substance, therefore, comports itself like a peculiar kind of resin, resembling that portion of mastic which is insoluble in alcohol, and it may be considered as an accidental principle in the new balsam; because all new balsams do not contain it, as I have satisfied myself by the examination of different samples brought directly to this city from Para and other countries by the *New York*. Out of three of these samples which were equally fluid, two had the pale yellow colour of balsam, but the third was considerably browner, like dark-coloured Xeres wine. All three were perfectly clear and had a strong smell, leaving, after boiling, from 40 to 42 per cent. of a dry resin. Mixed with two parts of a solution of caustic alkali, all three specimens, after frequent and strong agitation separated a transparent soap. The brown sample gave, in pure alcohol, a perfectly transparent solution, without the lest cloudiness. The two others, on the contrary, separated whitish flakes of a resinous nature, like that noticed above, their quantity was small, but tolerably equal.

If we seek the cause of this difference in their comportment, the explanation appears easy, by considering the age and state of vegetation of the plant. The multiplicity of species of the trees that yielded copaiba may also cause a difference. In all cases where a cloudiness of this nature is produced by alcohol, particularly when the balsam is new and fluid, it cannot be considered as caused by adulteration; so also the results to be required from a trial by pure alcohol (which on the other hand easily demonstrates the presence of fat oils and consequently ought not to be completely abandoned) ought to be modified in the following manner:—By intimate mixture with this liquid a deposit of a fluid fat oil ought not to be quickly formed, while a light flocculous cloud ought not to induce you to reject the yellow balsam, after it has in other respects exhibited a normal state, free from adulteration.

ON THE PRESERVATION OF WATER.*

BY M. PERINET.

M. PERINET, ex-professor of the *Hopital Militaire d'Instruction*, has succeeded in preserving water in a sweet state by placing a kilogramme and a half of black oxide of manganese in each cask of water containing 250 litres. He has kept this water for seven years in the same barrels, and exposed them to various temperatures; at the end of that time he found it as limpid, free from smell, and of as good quality as at the beginning of the experiment.

A CASE OF POISONING BY UNRIPE POTATOES.†

BY DR. MUNCKE.

MANY cases of poisoning by eating unripe potatoes have been recorded, but it has not, as yet, been shown to what chemical principle, solanine or any other, the deleterious action we have observed is to be attributed.

On the 4th August, 1843, the author was called upon, at half-past eight in the evening, to attend upon a woman about 43 years of age, thin, of a strong constitution, and not subject to illness. She had been seized about three o'clock with violent spasms, and vomiting, and passed stools containing fragments of potatoes, floating in a mucous fluid; she had the cramp in the palm of her hand and fingers, and her thumbs were contracted. Her strength was prostrated, her features anxious, and her pupils strongly dilated. Her face, chest, and extremities were cold, and her eyes haggard; her pulse was at 100, small, and at times scarcely perceptible; her tongue was clear, her epigastrum tender, when pressed; her breathing irregular, and sometimes interrupted by sobs. According to her relatives, the patient had remained insensible, without pulse or breath, and like a dead person, for half an hour, before the arrival of the medical man, and she did not recover her senses until she had got rid of a large quantity of potatoes by vomiting and stool. (Five grains of

* *Journal de Chimie.*
† *Medicinische Annalen.*

emetic tartar in a draught—to take a spoonful every ten minutes; mustard poultice to pit of the stomach.) Stools and vomitings, containing a considerable quantity of potatoes.

The woman, having completely recovered her senses, said that during the last fortnight she had eaten a large quantity of new potatoes, that she had been affected with diarrhœa for the last eight days, and that at her last meal, at midday, she had eaten more potatoes than on any previous day. At half-past ten in the evening, the general heat returned, the spasmodic contractions had diminished, the pulse was slower and stronger, and the tongue still remained clean. (Continue the emetic until the next day.)

The vomitings, which still continued, became, at length, simply bilious.

The 5th, a laxative draught produced seven stools.

The 6th, the cramps had completely disappeared. (Mucilaginous drink, and a little nourishment.) The appetite returned, perspiration and sleep.

The 12th, the cure was completed.

The question that remains to be solved is, whether this was simply indigestion, or poisoning. The author was inclined to believe the latter to have been the case.

ON THE ACTION OF AMMONIA IN HOOPING COUGH.*

BY R. H. ALLNATT, M.D., LONDON.

In the review of Dr. Aberle's work on "Tussis Convulsiva," (*The Lancet*, present volume, p. 551,) allusion is made to the treatment adopted by Dr. Wachtl, of Vienna, who recommends the employment of the ammoniated tincture of cochineal; and you ask, "how far might the ammonia contributes towards the good effect of the mixture?"

The immediate cause of the spasmodic action of the glottis, which occurs in this disorder, after the febrile action has, to a certain degree, subsided, appears to me to arise from morbid irritability of the stomach, which engenders an irritating secretion; which secretion, involving the bronchial tubes, trachea, and fauces, spurs their exhalent vessels to inordinate action. The excretions of the stomach, in this stage of the disease, if tested, will be found, almost invariably, to be of extreme acidity, sometimes so intense, as to excoriate in their passage the œsophagus, and roughen the teeth, as effectually as would a dose of dilute hydrochloric acid. Emetics, so greatly extolled for their virtues in subduing the paroxysms of hooping cough, act as temporary alleviants, by ridding the stomach of its acrid secretion; but the relief is transient, because the organ speedily resumes its disordered action. Many years ago, during a temporary visit at a populous town in the west of England, while the hooping-cough raged as an endemic to an alarming extent, many children falling victims to its attacks, I had an opportunity of testing the merits of practice founded upon the views I have here taken, and the result fully justified my anticipations, as the cases, however urgent, were rapidly and permanently relieved.

Dr. Wachtl, by his ammoniacal mixture, is stated to have "cured nine cases in from three to eleven days," and I fully believe the assertion to be quite consistent with truth. The liquor ammoniæ, the active ingredient of the formula, neutralised, in some degree, the acid matter with which it came in contact, and hence arose the benefit; but we have other alkalies, less stimulating in their action, and much more effectual, than ammonia.

After preliminary purgation with calomel, (conjoined with antimony, if the febrile symptoms run high,) and an occasional emetic to clear the stomach, nothing in my experience is so efficacious as small and repeated doses of the carbonate of potassa. The following combination has been extensively distributed to the poor in seasons when hooping-cough has raged as an epidemic, and I can attest the almost invariable success which has attended its administration—what portion of the merit is due to the cochineal I do not know:—Take of carbonate of potassa, one drachm; cochineal, 10 grains; boiling water, half-a-pint. For an infant, one teaspoonful to be taken thrice daily, the dose increased according to age.

In violent cases, much benefit will often accrue from the simultaneous employment of the following liniment, which is to be well rubbed, morning and night, over the whole course of the spine:—Hartshorn, and oil of amber, of each half an ounce. Mix *for a* liniment.

* *Lancet.*

ON CERTAIN PSEUDOMORPHOUS CRYSTALS OF QUARTZ.

BY R. WEBB FOX.

The paper from which the following extracts are made was read before the Royal Cornwall Polytechnic Society, on the 8th October, 1845; the crystals were found in

one of the heaps of veined stones at the consolidated mines.

They were broken from a copper vein in *killas*, at the depth of about 160 fathoms below the surface. The collector observed that many of the crystals contained water, and he secured some of it for me, by carefully breaking some of them. This he did mostly in my presence, and we had considerable difficulty in collecting even very small portions of the liquid in different phials. Two of these portions were nearly tasteless, or saline in a very slight degree, as far as I could judge from a single drop of each. In both, common salt was detected, and nothing else in one of the portions; but the other, when evaporated, left minute needle-formed crystals, which I was prevented by an accident from examining. The third portion of water was much more in quantity than both the others—nearly a teaspoonful, and obtained from only one crystal. It was very acrid to the taste, and gave very copious precipitates when tested by muriate of barytes and ferrocyanate of potash—showing the presence of much sulphuric acid and iron. Oxalate of ammonia, and nitrate of silver, indicated, moreover, the presence of lime and muriatic acid. The saline matter in this water, (mostly sulphate of iron,) was equal to one-tenth of its weight; and if it contained any common salt, of which I am not clear, the proportion was very small indeed. Litmus paper showed an excess of acid, the nature of which was not ascertained.

Many of the pseudomorphous crystals are more than an inch in diameter, and are partly, or entirely filled with crystalline quartz, whilst others are empty, or partly filled with more or less numerous fragments of disintegrated fluor. I counted nearly a hundred of such fragments taken from one of the crystals, or cavities, exclusive of many other very small pieces. All the fragments are corroded, and indicate, by their rounded edges and indented surfaces, the action of a solvent which penetrated most readily between the *planes of cleavage*. Besides this disintegrated fluor, perfect octohedrons of fluor occur in the same specimens; but they were rather more embedded in the quartz, and more protected from injury than the others. Water was found alone in some of the pseudomorphous crystals, or cavities, and in others, it was found with fragments of fluor, or with crystalline quartz.

The most perfect pseudomorphous octohedrons occur within large cavities in the quartz. Some of the latter are more than two inches in diameter, having the same form, and their sides generally parallel to those of the former.

The quartz specimens to which the crystals are attached, present, when broken, the appearance of fortification agate, having lines parallel to their structure, of transparent, and milk-white quartz, differing in thickness: these seem to indicate that the silicious matter had been deposited at intervals of greater or less duration, or at least, under different circumstances. After a time an entire change of conditions apparently occurred in the vein, and octohedral crystals of fluor were formed on the quartz; then silex was deposited either in a compact form or in minute crystals, and coated the crystals of fluor; afterwards fluor again appeared, forming octohedrons over the others, and mostly with sides and angles parallel to them. These processes appear, from some of the crystals, to have been again repeated:—then came a coat of silex over the fluor, or judging from the lines, many coats of it, forming a thick crust, having a surface of small quartz crystals. Some specimens were found at the same time with one or more layers of quartz, between two or more portions of fluor, which tend to confirm these views.

I think it may be inferred, from the well defined and smooth impressions which the octohedrons of fluor have left in the quartz, and the general parallelism of the sides and angles of the outer cavities to those of the smaller pseudomorphous crystals inclosed in them,* that the inner and outer crystals of fluor were perfect and uninjured until after the whole series of them were coated with quartz. After some subsequent period then, it would appear, that other changes occurred in the vein, and that the solution or destruction of the fluor commenced. Some of the cavities which were found to contain water only, as well as those which contained water together with disintegrated fluor, have the appearance of having been so hermetically sealed, that it is difficult to understand how the liquid solvent could have obtained access to the fluor and abstracted it from its case. It cannot be supposed that the pressure of the column of water above it, although equal to more than half a ton on some of the larger crystals could alone have produced the effects; for not only must the solvent have

* How are such coincidencies to be accounted for? Are we to assume that *polarising forces* have determined the arrangement? In many instances the layers of quartz which were *interposed* between the crystals are very thin, imperfect, and pervious to water; but in others they are not so, and some of the inner crystals now contain water.

been continually admitted through the crusts of the quartz, but the salts resulting from the solution of the fluor must, at the same time, have passed through them in the opposite direction, a sort of *endosmose* and *exosmose* must have existed, as I conceive, to produce the phenomena; whilst in other instances, the thick envelopes of quartz were impervious, and protected the fluor from injury. The salts resulting from the solution of the fluor must have been soluble, although this condition seems to present some difficulties under the circumstances of the case; and doubtless, the destruction of the fluor was very slowly effected in many instances, and in others it was begun but never completed. The differences in the saline contents of the water obtained from some of the crystals, is another circumstance of some interest, indicating the existence of different conditions in the vein, when the water was last admitted into the respective crystals.

The phenomena exhibited by these minerals cannot, I conceive, be accounted for but by supposing the water existing in the fissures of the earth, to have been changed by circulation from time to time, and to have been charged with different ingredients at different periods.

MISCELLANEA.

ROYAL COLLEGE OF CHEMISTRY.

[We were accidentally prevented from attending the interesting ceremony of laying the foundation stone of this highly important and much needed institution, and are therefore compelled to copy the following from a contemporary.]

The ceremony of laying the first stone of the new laboratory of the Royal College of Chemistry took place on Tuesday, the 16th inst., on the premises of the establishment, in Hanover-square. His Royal Highness Prince Albert performed the part of founder of the building about to be erected. There were also present Lords Clarendon, Ducie, Antrim, Palmerston, Ebrington, Sandon, Newry, and Morne; the Chevaliers Bunsen and Dronat; the Bishops of Norwich, Durham, and Oxford; the Dean of Westminster; the Hon. Mr. Bingham, Mr. Baring, M.P., Mr. R. Cobden, M.P., Mr. Bright, M.P., Mr. T. Wyse, M.P., Mr. W. Marshall, M.P., the Hon. Colonel Cathcart, Colonel M'Donald, Sir J. Clark, Bart., Sir R. T. Murchison, Bart., Sir G. Cayley, Bart., Sir T. C. Lemon, Bart., Sir. F. Lawley, Bart., Sir R. Westmacott, Bart., Sir R. Throckmorton, Bart., Professors Graham, Brande, Hofman, Redwood, Blyth, Wheatstone, and Drs. Paris, Holland, Prout, Southey, Grant, Pitman, Spurgin, King, and many other eminent professional and literary gentlemen; the Countess of Clarendon, Ladies Villiers, Newry, Needham, Murchison, Westmacott, &c., and a vast number of persons of rank and fashion interested in the proceedings. His Royal Highness having performed the ceremony of laying the first stone in the usual manner, briefly addressed the company, expressing his hopes that the results of the day would be propitious to the progress of science. The Earl of Clarendon also said a few words expressive of his good wishes for the prosperity of the institution, and the necessity which existed for its success. The Bishop of Oxford made a short but impressive speech on the occasion of the meeting, and alluded to the confirmation of the truths of Scripture by the advancement of scientific discovery. It appears by the announcement of the council, that after mature deliberation, and with the assistance of experienced men of science, the plans and arrangements to be carried into effect for the erection of the building are in every respect adapted to the purpose of a practical laboratory, and that the building about to be erected will be at least equal to any one at present existing in Europe. The assistance of the public towards the completion of this useful object is of course requisite, for it is estimated that the cost of the building, with the internal fittings and apparatus, will amount to the sum of 5,000*l.*; of this sum 2,000*l.* has been supplied by Mr. Blakemore's proposal of giving 500*l.* upon fifteen other gentlemen subscribing each 100*l.* Mr. J. Tomson, of Clitheroe, who has already given 100*l.*, is now ready to give 100*l.* more, conditionally that nine other gentlemen contribute a similar sum each, and is also at once an unconditional subscriber of 50*l.* That these liberal contributions will be the forerunners of others equally liberal, there is little room to doubt. The establishment is a national one, and one that has long been required; the public will reap the fruits of supporting, by their assistance, a College of Chemistry, in the supply of a body of well

educated practical chemists, who will not only be most beneficially employed in the medicinal department of chemical science, but by whose labours and experiments a great improvement in the economy of manufactures may be anticipated. Original investigations, conducted by eminent men in the laboratory about to be erected, cannot fail to advance the science of chemistry, and facilitate its application to the ordinary purposes of life, and to the purposes of the arts. His Royal Highness left almost immediately after the performance of the ceremony, and the company shortly afterwards broke up.

CAUSES OF CRETINISM.

Dr Roesch having been ordered, by the Government of Wurtenburgh, to inquire into the causes of cretinism, examined 3,000 cretins in different localities, where the disease was endemic. The following are the more important of the conclusions at which he arrived:—

1. Cretinism is sometimes sporadic, but in certain localities it is endemic.

2. It is hereditary, with the ordinary laws and exceptions to which hereditary diseases are subject.

3. The conditions for its development are hereditary predisposition, and the action of certain influences on the parents (such as want of sufficient food, unwholesome habitations, excessive labour, and debauchery), and accidental causes acting on the child, during the period of its physical and intellectual development.

4. These accidental causes are certain atmospheric and geological conditions peculiar to certain localities. Impregnation of the water with gypsum or lime, or melted snow, appeared to Dr. Roesch to exert no evident influence, for he met with cretins where the water was quite pure. But humidity of the air, he thinks, plays an important part. Cretinism is never endemic in plains, or on elevated "plateaux," whilst it is found in valleys, and "bas fonds" abounding in moisture. It does not exist in cold countries, where sudden variations of temperature are rare. All the localities in which it is endemic agree in being humid, foggy, and exposed to sudden changes of temperature, often very hot in the middle of the day, and cool, or even cold, in the morning and evening. Goitre constantly accompanies cretinism, is indicative of it, and is developed under the same conditions. These views of Dr. Roesch correspond exactly with those of M. Murchand, published in his inaugural thesis of 1842.

ON THE EFFECTS PRODUCED BY POISONOUS FISH ON THE HUMAN FRAME.

BY SIR W. BURNETT.

The author communicates a report which he lately received from Mr. Jameson, the surgeon of the flag-ship at the Cape of Good Hope, of the rapidly fatal consequences ensuing from eating small portions of the liver of a fish known at the Cape by the name of the bladder or toad fish, the *Aptodactylus punctatus*, or *tetrodon*, of Cuvier. The symptoms were chiefly pain and burning sensation at the epigastrium, constriction and spasm of the fauces and muscles of deglutition, rigidity of the tendons, coma, paralysis and convulsions, following one another in quick succession, and terminating in death within twenty minutes after the poisonous food had been taken. Several other instances of the same kind are next related; and a narrative is subjoined of the case of a seaman who lost his life, with similar symptoms, from the bite of a water-snake in Madras roads—the *Coluber laticaudatus* of Linnæus (*Hydrus colubrinus* of Shaw); and also of a ship's company who were all severely affected by eating portions of a large banacuda (*Perca major*). The author ascribes the symptoms induced by these deleterious substances to their action on the nervous system alone, there being evidence of congestion only, but not of inflammation, in the stomach and other viscera.

BATHS AND WASHHOUSES.

"The establishment for baths and washhouses in the Hampstead road," observes the editor of the *Athenæum*, "is admirably located for the extensive communication of the benefits proposed; and, in their anxiety to bring a portion of its accommodations into early operation, the committee have incurred a debt of some hundreds of pounds to various tradesmen for the fittings-up—the non-payment of which trifling sum stands in the way of the opening on the 1st of July.

"In Birmingham, a sum of 7,000*l.* was raised, a week or two ago, for the same object. At Manchester, a meeting was, recently, held to examine the principle, and the evidence in favour of its pratical application; and, seriously impressed with both, the merchants, as we are informed, put down their names as individual subscribers by the 1,000*l.* In this great and charitable metropolis, it has been only possible, with a committee thoroughly earnest in the cause, to get together a sum of 3,000*l.* for the establishment that seeks to supply cleanliness to

the great North-Western district. Nothing, we feel sure, can account for this but the supposition of the matter not having presented itself in all its importance to many who, in London, habitually dispense of their fullness to the wants of their fellows. It is not in a city like ours, that the want of a few hundred pounds could possibly be allowed to impede an object believed to be great and good. A visit to the establishment in George-street would be a powerful argument, in aid of ours. The arrangements are admirable; and there is something even affecting in seeing the poor thus cared for. The atmosphere of the place is wholesome to the growth of liberality. When it is remembered that, for the single penny for which the toiling mother bathes herself, she may bring all her children and bathe them too—we feel assured that it would strike the benevolent as something painful that these blessings should be postponed, even for a day, amid such weather as we have just gone through, and may soon have to encounter again."

Alluding to the same subject, the editor says:—"We have so dwelt upon all the moral considerations which are involved in the promulgation of this new law of cleanliness, that we could only repeat ourselves if we sought here to enforce that part of the subject. We could but speak, again, of its encouragement of that sentiment of self-respect which, where it does not beget, must be begotten by, the desire for personal cleanliness; and of all the moral fruits that grow upon that gracious stem—self-respect. Three-fourths of the petty vices which degrade society—and swell, under their most unwholesome conditions, into the crimes which ravage it—would shrink away from the light of self-respect. Of a moral agency like this it is difficult to limit, by anticipation, the purifying effects. But if the *physical* good were all that appealed to the benevolent, the argument would yet be of that kind and force which the benevolent never resist. They who have not paused on this matter, perhaps are not struck with the need of a charity like this. The difficulty is to make imagination descend into the realities of a poor man's home—to show, in their actual existence, the impediments which stand like mountains in his way, but look like mole-hills seen from without and from afar. It is only in the unfurnished interior of the toiling man's dwelling—by his very hearth—that they who seek to do him good can hear the teaching of the 'still small voices' that have not an utterance loud enough (terribly significant as they are) for such spaces as Exeter Hall.

"This particular charity is, perhaps, not the easiest in the world for fashionable benevolence to *realize*, as the Americans have it. It may have been thought that the poor have no need to be clean—do not want to be clean—and could be clean if they would. The second of the three objections has been disposed of by the eagerness with which the children of toil have travelled to these Jordans, wherever they have been, already, made to flow within their reach. Poor women, with their families, have trudged many miles that they might take back into their distant homes the comfort of cleanliness. For an answer to the first of the propositions supposed, we would that we could persuade every one to read the evidence of Dr. Southwood Smith and others who have been examined on the inestimable blessings of cleanliness, ventilation, and drainage; and on the dreadful evils to life and health—the long train of maladies which embitter existence, and make it short—that follow from their neglect. Such arguments as they present would need no help from pleading, with the benevolent; while the merely selfish man would become a subscriber to all means of cleansing, in the name of his fears. They who can be addressed in no higher language, may be reminded of their direct personal interest in the extinction of the long family of fevers from the neighbourhoods which they frequent. Here it is, that the prerogative of greatness is not complete. There is no barring the palace-door against malaria. Fever is an 'enemy' that will 'find out' the best of them, if left to prowl about the streets. The evil that he has allowed to grow great in its feeding on the poor, may meet the rich man at any turning. In spite of civet, it *will* stand somewhere between the wind and his nobility. He may 'nose it on' his own marble 'stairs.'"

HAIL CONTAINING HYDROSULPHATE OF AMMONIA.*

M. Peltier, in a letter addressed to the editor of the *Journal de Chemie de Medicale*, says, "During the night of the 26th and 27th of January, 1846, an extraordiary storm burst over Doué-la-Fontaine (Maine et Loire). At 10 o'clock in the evening, the sky was clear, the air quiet, and the thermometer about 51° F. There was no cause to expect the terrific phenomenon that a few hours later disturbed our rest. It was an hour after midnight when the thunder was first heard in the distance: a tempestuous wind blowing from the north-west, hurried

* *Journal de Chimie.*

towards us with extreme rapidity, enormous masses of clouds charged with electricity. An instant afterwards our town was directly under the thunder-claps; large and vivid flashes of lightning, instantly followed by terrible peals of thunder, succeeded each other with such rapidity that a single flame appeared to embrace the whole horizon; while the clouds thus hurtled together with horrible noise, a fall of hail, happily not extensive, fell, through its density, like a torrent. The sight of the myriads of frozen facettes, sparkling like so many rubies in the electric light, was magnificent. The earth was covered to the depth of 15 centimetres. A very perceptible hydrosulphurous smell filled the air, where it was least exposed to the wind; convinced that this peculiarity was due to the hail, and not to the locality in which it fell, I collected a number of hailstones, for the purpose of experimenting upon them.

Numerous chemical agents were applied to the hail, previously melted, without producing any reaction.

The colour of blue turnsole paper was not changed.

The same paper, reddened by an extremely weak acid, recovered its blue colour very slowly.

Concentrated mineral acids produced a sensible disengagement of hydrosulphide.

Acetate of lead gave a black precipitate, small in quantity, but extremely characteristic.

Triturated, along with quicklime, a disengagement of ammonia was clearly perceptible to the smell. Red and moist turnsole paper had its blue colour restored by the vapour.

I think I may conclude by these experiments that the hail was impregnated with a hydrosulphate of ammonia.

THE COAL FIELDS OF ALABAMA.*

BY CHAS. LYELL, ESQ.

A PAPER on this subject was lately read before the Geological Society. The author, in this paper, announced the fact, that the great Appalachian coal field of North America extends southwards as far as lat. 33° 10′, where it is covered up with beds of the cretaceous period. The coal is worked in open quarries at Tuscaloosa, near the centre of Alabama, and is there associated with carbonaceous shales, containing many fossil vegetable remains, recognised as of the same species as those found in the mines of Ohio and Pennsylvania. The strike of these coal beds is N.E. and S.W. The coal in this district appears to occupy the highest place in the carboniferous series of deposits, and with it occur white quartzose sandstone and grits, reposing on shales and clays containing seams of coal of less value. These are of considerable thickness, and overlie a great deposit of quartzose grit, passing downwards into thinly laminated sandstones. Next succeeds a group of fetid limestones, with chert resting on another limestone, in which occurs what seems to be a bed of brown hæmatite of vast thickness. The Alabama coal fields may be considered as forming three basins, of which the most western is not less than 90 miles long, and from 10 to 30 miles across, and the eastern is of nearly as great extent. The third is to the north, and appears to be of smaller dimensions.

* *Athenæum.*

THE MOSSES OF THE ALLEGHANY MOUNTAINS.

A SINGULAR, yet most useful work on the above subject has recently been published (if we may employ that term) in America. It consists of sets of specimens of the mosses themselves, with printed labels, title page, and index, prepared at no small labour and expense, and in an unusually elegant style, for distribution among the principal muscologists of Europe, and those interested in such pursuits in the native country of the author, Mr. W. Sullivant, of Columbus, in Ohio. The collection fills two large quarto volumes, and comprises 215 varieties of true mosses, and 77 of the paticæ; the descriptions are in Latin. The collection was made in the mountain district extending from Maryland to Georgia.

SEA SICKNESS.

A CORRESPONDENT in the *Lancet* observes,—

I believe, that in sea-sickness a churning motion of the blood is kept up in the large blood vessels going to the brain; and in the sinusses, &c. of the brain: sometimes there is too much blood, sometimes too little there: confusion takes place, and sympathetic nausea and retching, &c. from irregular distribution or circulation of blood in the brain.

It is acknowledged by seafaring men, that lying across the midship is the best position and remedy for the distressing effects, &c. of sea-sickness. We may reasonably agree to the fact, because the centre of the ship is the pivot on or from which the ship's head and stern rise and fall; the more you go fore or aft, the more the pitching is felt,

and the worse the illness becomes. So long as you keep lying across the mid-ships, and so long as the vessel does not roll, so long may you calculate on an improved condition. Perfect immunity from the evils of sea-sickness, in a swell, even in the most advantageous position, can never be expected; because, although you are in the centre, the point—out of a swell—where the motion is the least experienced, the whole vessel more or less partakes of the motion, and often, equally throughout, rises on a wave, and falls as it passes on. Neither brandy, soda-water, creosote, beef-steaks, or any other vaunted remedy, can keep off the evil. The most experienced seamen suffer on going to sea, after a stretch on the land, or rest on shore, in rough weather; so that all their knowledge on this point goes for nothing, and is of no avail, either to themselves or others, under certain circumstances. Nor is it to be wondered at, especially when we reflect that human knowledge cannot for a moment be supposed capable of controlling the laws of God, or, to modify this expression, can scarcely be supposed capable of controlling the effects of natural causes.

A SINGULAR METEOROLOGICAL PHENOMENON

Was observed at Vesoul, in the Haute Saône, on the 20th ultimo. About eight in the morning, the sun was surrounded by circles of different but distinctly defined colours. At the points nearest the vertical point of the observer were to be seen arcs of circles also coloured, the centres of which were outside the other circles, and the circumference of which touched them. By the sun passed a horizontal circle, the apparent diameter of which was equal to that of the sun itself. This circle was white. On its circumference were depicted two coloured images of the sun, one on the right, the other on the left, and then a third placed at a point opposite to that which was occupied by the sun itself. Thus were four suns to be seen at one time. This magnificent spectacle lasted nearly half an hour.

DISCOVERIES WITH THE GREAT REFRACTOR AT CINICINNATI.*

In an interesting communication published in the *Daily Atlas* (Cincinnati) of Feb. 11th, 1846, Prof. Mitchell, the able director of the Cincinnati Observatory, announces that he has devoted all the time he could command to an examination, with the noble instrument pertaining to that establishment, of a zone in the heavens, extending from 15° to 40° of southern declination. The number of new double and multiple stars already thus discovered amounts to one hundred and fifty-five. Of those of the former class, the most interesting is Antares, a star of the first magnitude in Scorpio, which, on the 13th June, 1845, Prof. M. detected to be accompanied by a minute stellar companion, distant only 1·7″, and this discovery he has confirmed by repeated observation. There is every reason to suppose that this splendid and often-observed star had never before been seen double. Of the latter class is a triple star in the Pleiades. When first discovered, several months since, the three stars were precisely in the same straight line. By an observation of Feb. 9, 1846, it appeared that "the line drawn through the two minute stars no longer passed through the centre of the larger star, and shows, conclusively, a rapid motion in the minute star next to the principal one." We shall wait, with much interest, for the many important discoveries yet to be revealed by the aid of this powerful instrument.

* *Silliman's Journal.*

THE COPPER SHEATHING OF VESSELS PRESERVED BY CHALK.

At a recent meeting of the Asiatic Society of Bengal, the presiding member, Charles Huffnagle, Esq., exhibited the curious piece of sheet copper forming the subject of the following memorandum, on which was clearly to be read the words *two foot* in chalk coloured by a thin oxidation of copper, but having distinctly preserved the copper below it from further wear, as stated in the note. "This copper was placed upon the steamer Hindostan in England, and since it was there fastened, the ship has passed over about 100,000 miles. You will perceive that *a chalk mark* made upon the copper still remains! and the portion of copper under this chalk mark is of *the original thickness*, while the friction, &c., has worn away every other part of its surface. Since this interesting discovery the owners of the ship Æneas have chalked over the whole of her copper with the hope of thus preserving it."

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month. Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

EXPERIMENTS ON THE BLOOD.*

BY M. DUMAS.

The blood contains three nitrogenated organic substances, which are essential to its nature and functions, namely, fibrin, albumen, and the substance of which the globules are composed. Their abundance, and the important functions they perform, have long attracted the attention of chemists and physiologists.

But if the fibrin of the blood is easily obtained by agitating the liquid after it has been taken from the vein, and the albumen is as readily collected, by allowing the serum to separate by spontaneous coagulation, it is not the same when we wish to procure the globules free from fibrin and albumen.

Latterly, a peculiar process, indicated by M. Berzelius, and carried out by M. Muller, led Messrs. Lecann and Figuier to the proper method of obtaining the pure globules, free from all mixture.

This method is based on a modification the blood undergoes, as far as regards its action in connection with the pores of the filtering paper, by the addition of certain salts. If we pour blood that has been deprived of fibrin, and consequently liquid, upon a paper filter, we shall perceive the globules of blood pass through, furnishing a dark-coloured liquid. The process of filtration, which is slow and troublesome, only leaves upon the filter a residue of damaged globules, and these in such small quantities as to render it impossible to study their properties.

But if, before the blood is filtered, it is diluted with three or four times its volume of a saturated solution of sulphate of soda, the mixture so modifies the properties of the liquid in which the globules float, that it passes through the pores of the paper, leaving the globules upon the filter. In this case, it flows through completely colourless, and liquid, and, as the filtration is rapid, the globules can be collected in a satisfactory state of purity and integrity.

Still, however, this mode of proceeding is not without several difficulties, which are worth attending to on account of the circumstances they disclose respecting the nature and use of the blood globules.

In fact, if we take blood deprived of its fibrin, but which has been drawn for several hours, and we endeavour to filter it, even after the addition of an excess of sulphate of soda, the liquid passes with difficulty through the filter, and is always coloured.

It is necessary, therefore, to operate upon blood recently taken from the animal. After it has been stirred, and the fibrin has coagulated, we pass it through a fine cloth, and receive it in the solution of sulphate of soda. The mixture being thrown upon the filter, we obtain a perfectly limpid liquid, slightly tinged with yellow, and all the globules remain on the filter.

Soon after, however, if the liquid that has flowed through is replaced by a fresh solution of sulphate of soda, for the purpose of washing the globules, we perceive it pass through tinged with colour, in the first place slightly, then rather darker, and finally it assumes so intense a red colour, that we cannot doubt that a great change has taken place in the globules on the filter.

But still, to obtain these globules in a pure state, we are obliged to wash them several times with a solution of sulphate of soda; without which they would still have a portion of the serum of the blood attached to them, that is to say, an albuminous liquid, whose presence would disguise their real properties.

After many failures I discovered a remarkable property in the blood globules, which enabled me to surmount this difficulty.

As long as the blood globules are in contact with air, or aerated water, in fact, as long as they are in an arterial state, the solution in which they are placed passes colourless through the filter and leaves them all behind.

On the contrary, as soon as the same globules have assumed a violet hue, the characteristic of venous blood, the liquid flows through tinged with colour.

It is necessary, therefore, to keep the blood

* *Comptes Rendus*, June 1, 1846.

in the arterial state during the whole process of washing and filtering. I have succeeded in doing this in a satisfactory manner, by plunging a slender tube into the filter and directing a constant and rapid current of air through the liquid.

When agitated in this manner the globules are not easily deposited on the sides of the filter; and, in additon to this, they are in an aerated state, favourable to the permanence of their arterial condition.

I therefore pour the blood, recently drawn from the vein, deprived of its fibrin, and diluted with the solution of sulphate of soda upon a large filter previously moistened with the same liquid—a current of air being constantly directed through the liquid in the filter; while, at the same time, a slender stream of the same solution continues to replace the liquid that has flowed through.

By taking these precautions the globules of blood may be deprived of their serum. But in every case, if we wish the operation to succeed, we must ensure its quick performance.

If the globules have time to be deposited on the sides of the filter, and form a layer of appreciable thickness, those which touch the surface of the paper no longer receive the air, and become of a violet hue; while those which constitute the outer coat of the layer continue in their arterial state, and evidently arrest all the air contained in the liquid with which they are washed.

From this instant the liquid begins to pass tinged with colour, and this discolouration continuing to increase every instant, the globules will become rapidly changed.

The blood globules comport themselves under these various circumstances as if they were really living beings, capable of resisting the solvent power of sulphate of soda as long as life remained, but yielding to its action as soon as they sink asphyxiated, owing to the privation of air—a fact that is manifested with singular rapidity, both by their change of colour and prompt solution.

On this account it is the object of the chemist to keep the globules living, and among the means that present themselves to our minds we may notice the agitation of the liquid, its constant supply with air, and, finally, the maintenance of the temperature at the degree in which it is found in the living animal.

All these precautions being taken, pure globules may be obtained in the course of a few hours, provided no attempt is made to prepare more than 5 or 6 grammes at one time.

The rapid change that takes place in the globules as soon as they are deprived of the presence of air, or aerated water, and the extreme energy with which those that form the surface of a layer absorb the whole of the oxygen contained in the water, allowing only a liquid improper for arterialising them to reach those below them, are facts well deserving the attention of physiologists.

In fact, in discussions and calculations, having reference to respiration, the blood has always been regarded as an homogeneous liquid, coming in contact with the air in the lungs, and undergoing more or less rapid changes.

There is no doubt that the serum of the blood is a liquid of this nature, and I have not disputed the part it may assume in the phenomena of respiration. But the globules of blood are so many vesicles, floating in their serum, endowed with a respiration of their own, the effects of which, confounded with those resulting from the respiration of the serum, produce, when combined, the general phenomena of the respiration of the blood.

We may, therefore, say, leaving out of the question for an instant the action of the serum on the air, which is peculiar to itself, that the respiration of a superior animal—of man in particular—has for its principal object the furnishing of oxygen to the blood globules, and the expulsion of the products into which they convert it.

From this it arises, that if we endeavour to calculate the effects of respiration, we must take into account the envelopes of these globules, for we know how different from the pure and simple solution of gases are the singular phenomena of endosmosis that take place through the membranes which separate two reservoirs, filled with different kinds of gas, or two liquids, also charged with dissimilar gases.

Respiration, therefore, to be well understood, ought to be studied in these vesicles or blood globules, the principal seat of the phenomena they are intended to accomplish, and whose organisation strangely complicates physical laws.

The mode in which these blood globules act on ambient or dissolved air, and the conditions under which they preserve their normal character, become, when regarded in this light, of indisputable interest.

Now, we have two methods, equally correct, for recognising the integrity of the globules and their fundamental properties; the microscope, and agitation with oxygen. So long as the globules are perfect, the microscope will indicate it, and as long as they can become arterial, they will redden by contact with oxygen.

Now, as every one knows that blood possesses both these properties in the circulation, and it does not lose them when it leaves the

body of the animal, the stirring of the blood, by which the fibrin is separated, leaves the globules untouched, and deprives them of none of their power of becoming arterial.

Albumen is no less indispensable than fibrin to produce this phenomenon; when we replace, by degrees, the serum in which the globules float, by a solution of sulphate of soda, they do not the less preserve their integrity, as the microscope shows us, and they do not become less red when agitated along with oxygen.

Thus the power of assuming the bright colour of arterial blood belongs to the globules; it is independent of the albumen of the serum, of the fibrin of the blood, or of the vital action of the animal.

But, if the sulphate of soda respects this property, will all the other alkaline salts do the same? Certainly not; experience proves it.

The ordinary phosphate of soda which exists in the blood, can, as well as the sulphate, be mixed with the blood to saturation, without in the least injuring its power of becoming arterial. Blood saturated with phosphate of soda, agitated, along with oxygen, assumes an arterial tint of a brighter red, perhaps, than before the addition.

Thus, in reference to this property at least, the blood can, without inconvenience, receive much larger quantities of sulphate or phosphate of soda than those it contains.

Salts produced by organic acids, as Rochelle salts, are in the same condition, and this permits us to believe that lactate of soda may exist in the blood, even in considerable quantity, without any injury arising on that account.

But is it the same with sea salt or chloride of potassium? Experiment shows that these salts possess very different properties.

If, after the separation of the fibrin, we saturate very recent blood with sea salt, and immediately agitate it along with oxygen, the colour becomes of a dull and of a violet tint.

Sal-ammoniac produces the same effect.

Is there any connection between these phenomena, and the charge that is laid against the too great consumption of salted provisions, namely, that it produces a predisposition for the scurvy? Must we also discover some similarity between the action of sal-ammoniac on the blood, and the poisonous effects exercised by the same salt, and by all ammoniacal salts?

Be it how it may, there are salts that leave the blood the power of becoming arterial, and others that deprive it of this property. Sulphate and phosphate of soda and Rochelle salt, are in the first condition, and the chlorides of potassium, sodium, and ammonium, in the second.

A circumstance, that cannot fail to attract our attention, presents itself in these results. The salts that support, in the blood, the faculty of becoming arterial, are, at the same time fitted for preserving the integrity of the globules, and imparting to them the property of furnishing a colourless serum by filtration. On the contrary, those which deprive it of the property of becoming arterial, allow more readily the filtration of a coloured serum.

The combined result of these experiments lead us to imagine, that the colouring matter of the blood is particularly fitted for assuming the characteristics of arterial blood, when united to the globules themselves of which it forms a part. This characteristic is modified or lost by the destruction or injury of the globules, and the colouring matter is in reality dissolved.

By carefully comparing portions of the same blood placed in contact with alkaline salts, and capable of being saturated with these salts, when cold, it appeared to me that, in general, these saline solutions, when agitated along with oxygen, comported themselves as follows:—

Salts containing complex organic acids, such as the tartaric and citric, preserved the integrity of the globules better than the salts of mineral acids.

Salts having soda for a base, are more adapted for the maintenance of this integrity than salts having a base of potash or ammonia.

An unexpected connection therefore appears to exist between the integrity of the globules, the arterial state of the blood, the phenomena of respiration, and the nature or proportion of the salts dissolved in the blood.

It is sufficient to have made several experiments of this nature, to be convinced that asphyxia may be induced in the atmosphere or in oxygen without an apparent change taking place in the phenomena of respiration merely by the introduction of certain salts which modify the behaviour of globules of blood in the presence of oxygen.

I venture to direct the attention of medical men to this series of phenomena; at a time when the analysis of the blood has so properly attracted their notice, it would be desirable that the study of the globules in several well-marked diseases should become the object of particular inquiry.

Every circumstance leads one to believe that there exists in their more slow or rapid change degrees capable of measurement, and which ought to be understood. If we were to receive the blood of the patient in a solution of sulphate of soda, and afterwards

submit it to different tests, or even, if, after having removed the fibrin, we were to endeavour to act upon it by graduated doses of properly chosen salts, such as sea salt and sal-ammoniac.

The greater or less resistance to these injurious salts would become indices, such as we do not at present possess in the diagnosis of diseases of the blood.

The elementary analysis of the blood globules became easy when they were once isolated, and this I have been able to effect with the greatest confidence in the result. Blood globules, well separated from the serum, collected in flat dishes and dried in *vacuô* by means of sulphuric acid, produced, in a very short time, a perfectly dry residuum. The latter, treated with ether and boiling alcohol, became insoluble in water, which was then able to remove the sulphate of soda that remained mixed with the globules. It was after these preliminaries I made the elementary analysis. The following are the results after deducting the ashes:—

BLOOD GLOBULES.

	Woman.	Dog.		Rabbit.
Carbon.....	55·1	55·1	55·4	54·1
Hydrogen....	7·1	7·2	7·1	7·1
Nitrogen....	17·2	17·3	17·3	17·5
Oxygen, &c..	20·6	20·2	20·2	21·3
	100·0	100·0	100·0	100·0

It evidently results from these analyses, as we concluded from the properties of the blood globules, that these bodies belong to the family of albuminoid substances. If the carbon they contain attains a rather higher figure than that of casein or albumen, it is because there exists in the blood globules a colouring matter much more carbonated than either of them.

In another paper I will endeavour to ascertain whether the substance of the blood globules can be confounded with albumen or casein; or if, as it appears probable it can be distinguished from these two substances as well as from fibrin itself.

A QUICK AND CLOSELY APPROXIMATING METHOD OF ESTIMATING COPPER BY MEANS OF A COLORIMETER.*

BY M. JACQUELIN.

THE process I ama bout to describe requires a balance capable of weighing one milligramme, three tubes, one of them only graduated, but each having an equal external and internal diameter, for the length of 5 centimeters only, at the lower part; a test glass, holding two decilitres, a small tube, nitric acid, ammonia, caustic potash, carbonate of potash, and distilled water.

There is no necessity for preparing a test liquor, and verifying its strength, every time an analysis is made.

It is only requisite to dissolve a portion of the mineral, or the alloy, to filter the liquid, having first added ammonia, and measured it, and finally, to add water to a known volume of the blue liquid, until its colour is the same as that of a normal solution contained in a sealed tube.

The weight of the copper is found to be in exact proportion to the total volume of the solution, when so reduced, as to assume the same colour.

This new method of analysis will show the weight of the copper to within $\frac{a}{1000}$, nearly. It includes all the cases to which M. Pelouse's process can be applied, and also the exceptions noticed in the memoir, saving that of cobalt.

As to nickel, it is rather troublesome; when its proportion is large with regard to the copper.

In fine, this mode of operation enables us to execute, with precision, all those commercial tests for which M. Collardeau proposed the use of his discolorimeter with diverging cylinders; and which enabled him to measure the discolouring power of animal charcoal.

It now only remains for me to give a few short explanations, for the purpose of showing the principles on which this mode of analysis by the colorimeter is founded.

Every analysis based on the employment of tests, by measure, requires a standard test liquid. What I have wished to avoid, for the sake of persons having a certain number of analyses to make daily, was, the trouble of preparing a normal liquid, and ascertaining its standard, every day.

To accomplish my intention, I proposed to weigh 0grs. ·5 of pure copper, and to dissolve it in weak nitric acid, to add to the solution a slight excess of ammonia, and to make up the complement with distilled water, so as to produce 1 litre of the solution at 60° F. This temperature can be obtained by immersing the vessel containing the solution in a pail of water.

The liquid is afterwards filtered, and placed in a tube holding 5 cubic centimeters, but not graduated, this being necessary only in the case of the third; the tube being empty near the upper part, is then hermetically sealed, so that the blue solution may retain its colour, from not being able to part with any of its elements, by evaporation.

* *Comptes Rendus*, June 8, 1846.

To procure three tubes of the same thickness and the same internal diameter, for the space of 5 centimeters near the closed end, it is only necessary to select three lengths from the same tube, carefully chosen, and to close one of the ends by means of the lamp.

I shall now notice the preliminary experiments I had to make, to determine the relative conditions of the preparation, and the stability of the normal liquid.

1. 5 cubic centimeters of blue cuprate of ammonia, prepared as above, on the 15th April, 1846, were compared with the same quantity of a similar solution, prepared on the 1st June, 1846, and their depth of colour was the same.

2. 5 cubic centimeters of the liquid, prepared on the 15th April, compared with solutions of the same standard prepared on the same day, with quantities of nitric acid and ammonia, varying from 10 to 100 grammes, all exhibited the same intensity of colour.

3. Solutions of the blue cuprate of ammonia, containing 1 gramme; 1·5; 2; 2·5; 3; 3·5; 4; 4·5; and 5 of copper to the litre, with a volume equal to five cubic centimeters, required additional volumes of water, exactly represented by 5, 10, 15, 20, 25, 30, 35, 40, and 45 cubic centimeters, to reduce their colour to the same shade as that of the normal liquid.

To make the comparison of the tints perfect, and independent of the unequal sensibility of the eyes, we placed the two tubes before a sheet of letter paper, of very even texture; we place them between the eye and the diffused light, and used, after the manner of an eye-glass, a flat-glass of a blue tint, fixed in a kind of hand screen with a circular hole of the size of 2 millimetres. This blue glass had the advantage of equally darkening both the tints we wished to compare.

Supposing we had employed 2 grammes of an alloy of copper and zinc, after dissolving it in nitric acid, and the addition of ammonia, I poured the whole into a glass holding two decilitres; if the solution under examination should not be as deep coloured as the normal liquid, instead of making it up to two decilitres, we make its volume equal to 150, 100, or 50 cubic centimeters, so as to be always obliged to add water to produce an equality in the tints.

I filter a portion of the measured liquid; for example, as much as 200 cubic centimeters: I place 5 cubic centimeters in the graduated tube and drop into it two or three drops of pure ammonia, and then water, by very slow degrees, taking care to shake it before each observation. The tints being equalised, I find that it requires 25 additional centimeters of water, and I calculated the richness of the alloy in copper in the following manner:—

The colour being the same, 30 cubic centimeters of liquid would represent 6 times the quantity of copper contained in 5 centimeters of the normal liquid, consequently we should write down 5c.: 30c.:: 0gr.·015: x = 0grs.·015 of copper, and for the total amount of copper, we should say, 5c.: 200c.:: 0gr.·015: x = 0gr.·6; that is to say, 30 per cent of copper.

ON THE SUBNITRATE OF COPPER.*

BY M. CHARLES GERHARDT.

Mr. Graham, some time since, proposed a theory on the subsalts, based, principally, on the composition of subnitrate of copper.

This salt contains, according to the celebrated English chemist, H^2O, N^2O^5, 3 Cu^2O, the neutral salt being Cu^2O, N^2O^2 3 H^2O.

In the subsalt, observes Mr. Graham, the 3 equivalents of oxide of copper replace the 3 equivalents of the *water of constitution*, and not basic, contained in the dry neutral nitrate.

Being myself engaged on various experiments on the nitrates, I was led, incidentally, to verify the composition of the salt on which this chemist based his speculations, and great was my surprise at discovering that its composition was not that which he attributed to it.

The subnitrate of copper is always obtained of the same composition, whether by decomposing the crystallised nitrate by heat, or by precipitating the salt by ammonia, employed in excess, or in an insufficient quantity.

Mr. Graham's formula supposes that 100 parts of the salt when analysed yields—

Oxide of copper	65·5
Water	4·9

In determining the copper, Mr. Graham confined himself to a single experiment.

I here notice the experiments I made myself.

I. 0 gr. ·647 of subnitrate of copper, dried at 212° F., and obtained by the fusion of crystallised nitrate, yielded 0·428 oxide of copper.

II. 0 gr. ·480, of another preparation, obtained also by fusion, but dried at 482° F., produced 0·318 oxide of copper.

III. 0 gr. ·621, of a third preparation, decomposed over metallic copper, gave 0·075 water.

IV. 0 gr. ·863, precipitated by ammonia,

* *Comptes Rendus*, June 8, 1846.

in insufficient quantity, and dried at 482° F., yielded 0·573 oxide of copper.

V. 0 gr. ·388, of the preceding salt, dried at 212° F., only gave 0·257.

VI. 1 gr. ·037, precipitated by an excess of ammonia, so that a portion of the salt was redissolved, and dried at 212° F., gave 0·687 oxide of copper.

VII. 1 gr. ·749 of a salt prepared by precipitation, and dried at 212° F., gave 0·213 water.

VIII. 1 gr. ·595 of another salt, prepared by the fusion of crystallised nitrate, and dried at 302° F., gave 0·138 water.

According to these analyses, the composition of subnitrate of copper is—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Oxide of copper	66·1	66·2	—	66·2	66·2	66·2	—	—
Water	—	—	11·8	—	—	—	12·0	12·1

These results show that the subnitrate of copper has not the composition attributed to it by Mr. Graham, and its true formula is—

$$N^2 O^5, 4\,Cu^2 O, 3\,H^2 O,$$

Or, according to my notation,

$$N\,(H^3\,Cu^4)\,O^6,$$

The crystallised nitrate being

$$N\,(H^6\,Cu)\,O^6.$$

According to this, Mr. Graham's theory is not confirmed by experiment.

A MEMOIR ON A MODE OF PRECIPITATING IRON, MANGANESE, AND NICKEL FROM THEIR SOLUTIONS IN A METALLIC STATE.*

BY M. A. I. POUMAREDE.

THE study of the salts of iron on which I have been already engaged for several years has enabled me to observe, among other facts, certain phenomena in their reduction; an account of which I deposited with the Academy, in 1843: I have now decided on publishing it, and consider that it is worthy of the notice of chemists, and that, sooner or later, it may be of service in metallurgy.

While examining the action of the salts of zinc on solutions containing a maximum of salts of iron, I long since observed that the phenomenon of reduction, with the disengagement of hydrogen, which occurs in this case, and which is known to all, either does not take place at all, or does not commence, until the surface of the zinc has changed colour, and has acquired a tint much darker than that which is natural to it; a colour that passes into an ochrey tint by simply exposing the fragments of zinc to the air. Having also remarked that pure zinc, which, as Fourcroy formerly observed, does not decompose water under the influence of sulphuric acid, does so on the contrary in the present case,† and that the action does not take place until the above-mentioned discoloration of the zinc has manifested itself. I was naturally led to suppose that this disengagement of hydrogen, this decomposition of of water, might not arise, perhaps, as it is generally supposed to do, from the oxidation of the zinc; but, from that of a quantity of iron, which, on account of the antagonism of iron and zinc in the presence of a limited quantity of oxygen, or from some other cause, found itself excluded from the solution, and formed an element of the pile, which produced the above-mentioned reaction.

And this mode of considering it appeared to me to be the more probable, because, to explain the phenomenon in any other manner it would be necessary to be in violent opposition to that fundamental principle of chemistry which declares that there is a constant proportion between the oxygen of the oxide and the degree of oxidisation of the oxide.

On the other hand, having also remarked that this change of colour in the zinc, that this deposit, which is formed on its surface, became more apparent, and the disengagement of hydrogen less rapid, as the ferruginous solution, became more concentrated, I could also imagine that the affinity of the salt in solution for water, might easily, in some cases, counteract the tendency of the liquid to become decomposed, as occurs, for example, in analogous cases, in the instance of sulphuric acid in a certain state of concentration; and from this I could foresee that, by varying my experiments, it it would, perhaps, be possible for me to arrive at more conclusive results.

In fact, by treating extremely concentrated solutions of the salts of the sesquioxide with common or distilled zinc, it was easy to see, that at the same time that the salt was reduced to its minimum, a quantity of iron was always deposited in the state of small shining tablets, which did not oxidise by the decomposition of the water, if, as the liquids became too much diluted, we took the precaution of separating the fragments of zinc from the surface, as they were formed, by frequent agitation.

In addition to the metallic lustre, which is

* *Comptes Rendus*, June 8, 1846.

† These experiments were made on the sulphate of sinoxide of iron.

always impaired by desiccation, iron thus obtained possessed all the properties of the ordinary metal. It decomposes water under the influence of an acid, burns with a smoky flame on paper, &c., &c.

To establish the theory of this reaction, and express it by an equation, it is necessary, as we have observed, to cause the zinc to act on an indeterminate quantity of chlorine, merely taking care, in this case, to avoid the fixation of the oxygen of the air, which would complicate the results, by placing the mixture in a wide-mouthed bottle, large enough to avoid the necessity of opening it more than once or twice, to allow of the escape of the disengaged hydrogen.

We had afterwards carefully to determine, in the products of this reaction:—1. The quantity of iron reduced to a metallic state; 2. The quantity of iron in the whole of the sulphate of the protoxide of the liquid; 3. And finally, the quantity of iron or oxide accidentally lost, which is shown by the quantity of peroxide separated from the liquid. These three numbers once ascertained, we must add the last to the first, and deduct the second; observing, that the quantity of iron accidentally oxidised which it expresses, should form a part of the iron precipitated in a metallic state, while it is completely distinct from the iron reduced to a state of protoxide, with which it was determined.

I suppress the details of the analysis in this place, which it would be tedious to go over; and merely add, that all the numbers were obtained by a determination of the products in the state of peroxide.

Peroxide yielded by the sulphate of the protoxide	16·17
Peroxide yielded by the metallic iron	4·32
Peroxide yielded by the iron accidentally dissolved, and shown by the peroxide ($0{\cdot}53\ Fe^2\ O^3 = O^3 = 0{\cdot}715\ Fe^2\ O^3 = 0{\cdot}836\ Fe^3\ O^6$)	0·836

The preceding numbers sufficiently show, that the precipitated iron is clearly the third of that which remains in solution, and that the reaction ought to be expressed by the following equation:—

$$Fe^4\ O^6\ 6\ S\ O^3 + Zn^3 = Fe^3\ O^3\ 3\ S\ O^3 + Zn^3\ O^3\ 3\ S\ O^3 + Fe.$$

In superoxidising the mixture of the salts of the protoxide, resulting from a previous reduction, we may precipitate a fresh quantity of iron, and thus, by successive operations, succeed in precipitating the whole of the iron in the solution.

We thus clearly perceive that the zinc reacts on the salts of iron, at a maximum, in a clear and decided manner, and that we thus have a simple, and sufficiently economical means of procuring iron chemically pure, a method which has no resemblance to those already known, and among others those of Capilaine and Becquerel, and of several manufacturers, who obtain iron by the galvano-plastic process, all of which are methods that are connected with the effects of deposition by the galvanic pile. All that has been said above respecting iron, appears to me to be equally applicable to the greater number of metals of the same nature; for, as we shall see, by reactions, which, if not identical, are at least, apparently, extremely analogous. I have succeeded in precipitating nickel and manganese from their solutions, and the salts of aluminum have afforded me results which cannot be completely isolated from the latter.

AN EXPERIMENTAL DEMONSTRATION OF THE OXYGEN IN SILICIC AND BORIC ACIDS.*

BY M. LOUVET.

I HAVE discovered a very simple method for separating the oxygen from the silicic and boric acids.

To perform this experiment, I, in the first place, prepare a fluoride of silver, by saturating liquid hydrofluoric acid with pure oxide of silver, evaporating the liquid in a silver capsule, and pouring the product into a silver crucible, furnished with a cover. The fluoride of silver melts at a heat below redness; in this state it is poured upon a plate of fluor spar, it is broken to pieces quickly, and placed, either in a platinum or silver vessel, carefully closed. To separate the oxygen from the silicic acid, I first take a piece of tube, about 8 or 10 centimeters in length, and from 1½ to 2 in diameter; I close one extremity hermetically, and, first throwing a little dry white sand into the tube, I afterwards place in it a few pieces of fluoride of silver; I then entirely fill the tube with dry sand, and place in it a cork, furnished with a bent tube, and leading to the mercury trough. The tube is then carefully heated, and the gas is soon given off. When we imagine that the air in the tube is

* *Comptes Rendus*, June 8, 1845.

entirely expelled, we place its extremity beneath a small bell glass, filled with mercury. When the bell is filled with gas, if we introduce a piece of phosphorus, which we afterwards light by means of a blow-pipe (keeping the phosphorus in the middle of the mercury, so as not to break the bell), about half the gas will be absorbed. If, after this, we place in the glass a piece of caustic potash, and a little water, nearly all the remaining gas will disappear. There remains, therefore, a small quantity of gas, of which, at first, I could give no account, but further inquiry proved to me that it was phosphoretted hydrogen gas, produced by the reaction of the alkaline liquid on the phosphorus, which was in excess in the bell-glass. If, after having collected a certain quantity of gas, we pass potash and water through it, half the gas is absorbed. By plunging into what remains a piece of tinder, having several points in a state of ignition, it burns as if in pure oxygen.

According to calculation, 1 equivalent of silicic acid, SiO^3, is converted into 1 equivalent of fluosilicic acid, SiF^3;* for 1 equivalent of fluosilicic acid gas produced 3 equivalents of oxygen are therefore liberated. The density of oxygen is 1·1026, that of fluosilicic gas 3·600. In accordance with these data, when silicic acid is converted into fluosilicic gas, by the action of fluorine, the amount of oxygen and fluosilicic acid gases produced, ought to be in proportion to each other, by volume, as 272 to 273. In one experiment, I collected 57 cubic centimeters of gas, at a pressure equal to 0·754; by passing potash and water into the bell, 29 cubic centimeters were absorbed, there remained, therefore, 28 cubic centimeters of oxygen gas. The difference between 28 and 29 is greater than that between 272 and 273; this is probably caused by a small quantity of oxygen being absorbed by the water. In another experiment, I collected 29 cubic centimeters of gas, at a pressure of 0·754; by passing a piece of phosphorus into the bell, and burning it there, 16 cubic centimeters were absorbed, and 13 cubic centimeters remained in the bell. Here we have too high a figure for the oxygen; but it is possible that the phosphorus absorbed a small quantity of the fluosilicic gas. Another circumstance may also have occasioned the loss of a small quantity of the gas, for in this second experiment, the inside of the bell was rather moist, and after that a certain quantity of the acid gas might have been dissolved. I may observe here, that the fluosilicic gas obtained in this manner, did not act on the moist glass in the usual manner; it did not remove its polish.

Experimenting with anhydrous fluoride of lead, in powder, and mixed with white sand, nothing was disengaged, probably the fluorine was converted into a fluosiliciuret and oxide, combined with the silex. I afterwards took the blackish-brown mass, obtained by applying a strong heat to fluoride of mercury, in a platinum cup; which is considered as a double fluoride of mercury and platinum. The apparatus was arranged as in the preceding experiments. The gas was soon disengaged, and collected; when the air of the tube appeared to have been expelled, it smoked as soon as it reached the outer air. The quantity collected amounted to 55c. ·5, at a pressure of 0·760. By means of potash and water 5 cubic centimeters, only, were absorbed; the gas that remained comporting itself like pure oxygen. I attribute this excess of oxygen to the presence of oxide of mercury in the fluoride; which would then be an oxyfluoride. Metallic mercury was condensed in the upper part of the tube. In a second experiment, with the same fluoride of mercury, I obtained 23 cubic centimeters of gas, at a pressure of 0·754. By means of phosphorus, 15 cubic centimeters were absorbed; there was then much less oxygen left than in the preceding experiment; this proves that the oxyfluoride of mercury is not the same through the whole mass. In fact, those portions that were in contact with the platinum, and which had been exposed to the direct action of the heat, were much darker coloured than the central parts, thus indicating a difference of composition. Finally, in a third experiment, I collected 10 cubic centimeters of gas at the pressure of 0·754. By means of potash and water, there was an absorption equal to 1c. ·5.

To obtain the oxygen from boric acid, it is only necessary to heat a simple mixture of melted fluoride of silver, and anhydrous and pulverised boric acid; by acting in this manner no gas is disengaged, the boric acid melts, and makes a hole in the tube. I mixed boric acid with an excess of fluor-spar, in powder, and I poured it over fluoride of silver in a tube, at the bottom of which was powdered fluor-spar; I took care so to dispose the fluoride of silver as to prevent its coming in contact with the sides of the tube, and, in this manner I obtained a mixture of fluoboric gas and oxygen, 1 equivalent of boric acid, BO^6, converted into fluoboric gas, BF^6, absorbs 6 equivalents of fluor, disengaging, consequently, 6 equivalents of

* These formulæ represent equivalents not atoms.

oxygen. The density of fluoboric gas is 2·3124, that of oxygen, 1·1026, calculating, according to these numbers, when boric acid is converted into fluoride of boron, by the action of fluor, it ought to yield fluoboric acid, gas, and oxygen, whose separate volumes should be as 36 to 27. In one experiment I collected 14c.·5 of gas, at the pressure of 0·754; by means of potash and water, only 6 cubic centimeters were absorbed.

ON THE SUPPOSED PROPERTY OF THE BILE OF CONVERTING SUGAR INTO FAT.*

BY DR. J. SHIEL.

In a treatise on the origin of fat in the animal body, Dr. Meckel describes some experiments made under the superintendence of Dr. Marchand, which, according to his view, completely explain the part which the bile acts in the process of digestion. In the opinion of Dr. Meckel, the bile is destined to transform the sugar, and consequently all articles of food free from nitrogen, into fat. The way in which Dr. Meckel describes his experiments leaves, however, room for doubting whether he actually obtained fat. He produced, by exposing a mixture of 110 grammes of bile and four grammes of grape-sugar for twenty-four hours to moderate heat, and then treating it with ether, besides some cholesterine, another body which dissolved in potash, which is the whole of his proof for its fatty nature. The doubt as to the correctness of these experiments is increased by the simple consideration, that the carnivorse likewise secrete bile, which is not widely different in its composition from ox-bile, and which certainly cannot be destined to transform the sugar which this class of animals devours, or rather, does not devour, into fat. The results of some direct experiments which Dr. Shiel has made on this subject do likewise not confirm the view taken by Dr. Meckel.

About half a pound of fresh ox-gall was shaken with ether as long as anything was removed from it, and then mixed with about an equal weight of a concentrated solution of sugar prepared from starch with diastase; the mixture was kept in a closed vessel for forty-eight hours, in a water-bath at a temperature of 97°, and then divided into two equal portions. One of these was shaken for half an hour with half a pound of ether, and the decanted ether evaporated. It left a scarcely appreciable quantity of a greenish body, which, from its small amount, could not be submitted to further examination. The second portion was retained for twenty-four hours longer, at the above temperature, and then shaken with ether, to which it yielded, besides a trace of cholesterine, a small quantity of a body likewise coloured green by a biliary colouring substance, and which, on solution in potash, precipitation by muriatic acid, and solution in alcohol, remained, on evaporation of the latter, as a viscous substance, presenting not the least trace of a crystalline appearance.

SECOND EXPERIMENT.

About half a pound of fresh ox-gall was filtered, and divided into two equal portions; one was preserved separate, and the other mixed with a solution of about 70 grms. of grape-sugar prepared from honey, and both exposed in an open flask for forty-eight hours to a temperature of 94°—98°, and then extracted with ether. The first portion yielded to this, with the exception of cholesterine, a mere trace of a body soluble in potash, but which, on neutralisation with an acid, merely rendered the liquid opalescent. One-fourth of the ether with which the second portion had been agitated was evaporated; it left scarcely 0·2 grm. of a greenish substance, which contained cholesterine, and yielded to potash a matter which precipitated from the alkaline solution, and dissolved in a little hot alcohol, separated in flakes, and formed on evaporation a yellowish-white viscous substance without any appearance of crystallisation, and which melted at 124°—126°.

It is evident, from these experiments, that bile and sugar, with absence of air, do not act on one another, but that with the access of air the decomposition of the bile is hastened by the presence of the sugar. [The substance obtained can scarcely be anything further than a product of the decomposition the bile].

ON THE PRESENCE OF CARBONATES IN THE BLOOD.*

BY PROF. R. F. MARCHAND.

In a previous investigation of the salts contained in the human blood, I found a quantity of carbonic acid equivalent to about one-half to three-fourths per cent. carbonate of soda. Enderlin, in his researches on the composition of the ashes of the blood, has come to the opposite conclusion, asserting that they contain no carbonates, that no such salts are contained in the blood, and that its

* *Liebig's Annalen*, April, 1846, and *Lancet*.

* *Jour. fur Prakt. Chem.*, and *Chemical Journal*.

alkaline reaction, as well as that of the ashes, is solely caused by the tribasic phosphate of soda $3Na\,O\,P^2\,O^5$. On this occasion Enderlin states, that "we must further conclude, from the presence of the tribasic phosphate of soda in the ashes, that the basic phosphate of soda of earlier chemists in the blood is $3Na\,O\,P^2\,O^5$; since only this salt, even after ignition, is still tribasic, and produces the same yellow precipitate as the ordinary phosphate of soda." Further, "if the ordinary phosphate of soda, $2Na\,O + HO,\ P^2\,O^5$, occurred in the blood, the ashes should contain bibasic phosphate (pyrophosphate), because the third atom of base escapes on ignition." And again, "if the ashes of blood be left exposed for several hours to a moist atmosphere, and a little acid be subsequently poured over them, a slight effervescence occurs. The basic phosphate of soda becoming converted, in moist air containing carbonic acid, partially into carbonate of soda, $3\,Na\,O,\ P^2\,O^5$ becomes $2\,Na\,O + HO,\ P^2\,O^5$, and $Na\,O,\ C\,O^2$. The third atom of fixed base is replaced by 1 atom of a volatile base (HO). On ignition, the carbonic acid is again expelled with the water, and we have $3\,Na\,O,\ P^2\,O^5$." Lastly, "the behaviour of the serum of the blood towards carbonic acid gas, as well as all the phenomena of the process of respiration, are fully explained by the presence of tribasic phosphate of soda in the blood. Both the phosphates $2\,Na\,O\,HO,\ P^2\,O^5$ and $3\,Na\,O\,P^2\,O^5$ are remarkable from their property of absorbing a quantity of carbonic acid."

From facts which Enderlin discovered, and which every one who has examined ashes of the blood will have confirmed, it is, however, impossible to come to a direct conclusion as to the salts contained in the blood not reduced to ash, as that chemist, however, has done.

In my analysis of the salts of the blood, the blood was evaporated to dryness, and retained for a considerable time at 284° to 320°, then exhausted with water, and the substances dissolved in this aqueous extract determined. The insoluble mass was exhausted with muriatic acid, and this extract likewise submitted to analysis. The insoluble residue still remaining was reduced to ash, which was likewise analysed after deducting the peroxide of iron, which added to the blood-red only. My analyses, which were made more than six years ago, cannot be considered analyses of the ashes of blood.

It is readily perceived that, from the composition of the ashes of the blood and of organic bodies in general, no direct conclusion can be made as to the salts contained in the organic substances themselves. The circumstance that no carbonates were found in the ashes does not prove in the least that they are not contained in the blood; just as little are we justified, because we find the tribasic phosphate of soda in the ash, in admitting, unconditionally, that it is likewise contained in the substance. This does not apply to the blood alone, but just as much to seeds and other vegetable substances.

The protein compounds of the blood contain sulphur and phosphorus. If they are reduced to ash, and any carbonate of soda is at the same time present in the substance, it must necessarily be decomposed, and sulphate and phosphate of soda formed. If we admit that this does not happen, and that the sulphur and phosphorus act in some other way, we must nevertheless not be astonished to meet with no alkaline carbonates in the ash. Supposing bibasic phosphate of soda to be contained in the blood, it would be impossible, with the presence of carbonate of soda, to detect this latter in the ash. It is scarcely necessary to observe, that bibasic phosphate of soda, ignited with carbonate of soda, is converted into tribasic phosphate, a reaction therefore which renders it impossible to determine from the ash whether the salt $2NaO\,HO,\ P^2\,O^5$ and $Na\,O\,C\,O^2$ or $3Na\,O\,P^2\,O^5$ is contained in the substance.

I will finally observe, that the admission of the presence of $3\,Na\,O\,P^2\,O^5$ in the blood absolutely requires the admission of that of carbonate of soda. It has been indisputably proved that $3Na\,O\,P^2\,O^5$ is converted, on exposure to moist atmosphere containing carbonic acid, into $2\,Na\,O\,HO,\ P^2\,O^5$ and $Na\,O,\ C\,O^2$. Just as firmly is the fact established, that the blood contains several times its volume of free carbonic acid, and that we can remove this gas both from the venous and the arterial blood by mere pumping. The tribasic phosphate can scarcely exist in a liquid containing this gas in solution without being changed into bibasic phosphate and carbonate of soda, which latter must necessarily pass into bicarbonate of soda, as a very little time suffices to produce this change in a solution of $3NaO\,P^2\,O^5$ by the air of a room. If, therefore, only so much carbonate of soda is contained in the blood, that the amount of soda is but half that of the bibasic phosphate, the carbonate must disappear on the reduction to ash, and form $3\,Na\,O\,P^2\,O^5$. If the amount of carbonate of soda is greater, this salt is the more surely formed, and nevertheless the carbonate will entirely disappear, owing to the amount of sulphur and phosphorus in the protein compounds. To prove the presence or absence of the carbonated alkalies in the blood, we must examine it in its natural state. Liebig has lately

made some experiments which confirm those of Enderlin. He arrived at the result, that no carbonated alkalies are contained in the blood, and that the alkaline reaction is due to phosphate of soda. Since free carbonic acid exists in the blood, this phosphate must be 2 Na O HO, $P^2 O^5$; and how is it possible that 3Na O $P^2 O^5$ can be formed on the reduction to ash in the absence of carbonate of soda?

"It does not follow, as Liebig supposes, that because muriatic acid produces no perceptible disengagement of carbonic acid from a liquid, that this contains no carbonates, since the eliminated acid may remain dissolved in the liquid, and the more so if it contain a substance in solution which has a tendency to absorb carbonic acid. The following experiments will serve to illustrate this more fully.

4·5 grms. NaO C O^2 were dissolved in 450 cubic centimeters water. 100 cubic centim. of the solution were mixed over mercury with sufficient muriatic acid to decompose the whole of the carbonate. After a considerable time and some shaking, 60 cub. centim. of carbonic acid (measured at 32° and 29·9 Bar.) were found to have been disengaged. This amounts to about 118 milligrammes. If the entire quantity contained in the liquid had been disengaged, 415 milligrammes ought to have been evolved.

3·5 grms. Na O C O^2 were dissolved in 550 cub. centim. of the solution, decomposed in the same manner, liberated 11·5 cub. centim. carbonic acid, therefore about 22 milligrms. The solution contained 636 milligrms. carbonate of soda, therefore 264 milligrms. carbonic acid; of which eleven-twelfths remain in the solution, and only one-twelfth escaped as gas.

Upon this 0·318 grm. carbonate of soda was dissolved in 100 cub. centim. water, and decomposed by hydrochloric acid over mercury. The quantity of gas given off was scarcely measurable, although the liquid contained 132 milligrms. carbonic acid. It should moreover be observed, the barometer stood in the first experiment at 29·0, in the second at a pressure of 25·1, and the third at a pressure of 23·6, the temperature being 50°. When, therefore, less carbonate of soda is contained in the liquid than in the third experiment, no evolution of gas will be perceived on the addition of hydrochloric acid.

When a liquid contained, along with the carbonated alkali, bibasic phosphate of soda (2Na O HO, $P^2 O^5$), the evolution of gas will be still more difficult to perceive, as this salt has a very great tendency to absorb carbonic acid.

The concentrated solution of the salt, of 1·046 spec. grav. absorbed at 54° and 29·6 Bar. about 3 times its volume of carbonic acid, for 6·5 cub. centim. solution took up 21·2 cub. centim. carbonic acid; 100 vols. solution absorbed therefore 326 vols. carbonic acid. From this result it was to be expected that a mixture of phosphate of soda and a solution of the carbonate would essentially diminish the evolution of gas by hydrochloric acid.

100 cub. centim. solution of carbonate of soda containing 0·636 grms. salt, or 0·264 carbonic acid, were mixed with 30 cub. centim. of saturated solution of phosphate of soda, and then decomposed with hydrochloric acid. There was now evolved, with a pressure of 25·9, 3 cub. centim. carbonic acid, therefore at 32° and 29·9 Bar., not quite 2·5 cub. centim, while the same quantity had previously liberated 11·5.

I think these experiments sufficiently prove that it is not safe to conclude on the absence of carbonates, because no evolution of gas is perceptible.

The quantity of carbonic acid which is absorbed by the solution of phosphate of soda is more considerable than we should expect from analogy with the capacity of absorption of other saline solutions of equal density. De Saussure found that a solution of alum of 1·047 spec. grav. absorbed only 70 vols. carbonic acid to 100 vols. solution. It is therefore not improbable that the affinity of the carbonic acid to the phosphate of soda is an entirely peculiar one, and different from that towards other salts, by which it is absorbed quite mechanically. When the solution, saturated with carbonic acid, is evaporated at 104°, the crystalline mass disengages a little carbonic acid with dilute sulphuric acid.

When a concentrated solution of the phosphate of soda, 2 Na O HO, $P^2 O^5$, perfectly saturated with carbonic acid, is placed under the air-pump, scarcely any evolution of carbonic acid is found to take place on exhaustion, when the barometer has fallen to 8 inches. A few bubbles ascend along the side of the vessel, but the gas escapes in large bubbles, only, when the barometer has fallen below 1.

The great resemblance which exists between this behaviour, that of the blood, and that of the bicarbonate of soda, and the difference between other solutions containing gas, is rendered more evident by the following simple experiment:—4 beakers of equal size were placed under the bell-glass of an air-pump; they were filled to the same height with beaten blood, a concentrated solution of bicarbonate of soda, phosphate of soda, and chloride of sodium. The last two were

completely saturated with carbonic acid. The exhaustion proceeded slowly, so that the state of the barometer could be observed during the whole time. With the first strokes of the pump the gas escaped from the solution of chloride of sodium, and at 8 inches this formed a strong effervescing liquid, while in the blood and in the solution of phosphate of soda, scarcely any bubbles of gas ascended. The bicarbonate of soda exhibits not the least evolution of gas. On stronger exhaustion, the solution of chloride of sodium quite boils, if it has not already lost too much gas from the duration of the experiment. At 2 inches, the blood and the solution of phosphate begin to give off bubbles, which escape abundantly at 1 inch. The bicarbonate remains unaltered, and it is only with an almost perfect vacuum that any carbonic acid is disengaged, as has been very fully shown by Rose.

The phosphate of soda, 2 Na O HO, $P^2 O^5$, retains the carbonic acid like the blood, but like this not the whole quantity, with the same force as the bicarbonate of soda, yet with far greater tenacity than any other saline solution.

I now modified the experiment with the blood in the following manner:—The mass obtained by evaporating 5 lbs. of blood in a retort was not conveyed into a tube over mercury, but into a long-necked flask, closed with a cork, through which a long funnel and a tube for conducting away the gas were inserted; this latter was fitted air-tight into a Woulff's flask, which was half-filled with a clear solution of barytes. On heating the liquid in the flask to gentle ebullition, the steam passed through the barytic solution, causing not the slightest turbidness during the course of half an hour; but on pouring dilute sulphuric acid through the funnel, and continuing the gentle boiling, a white precipitate very soon formed, which subsided in dense flakes, and after separation from the clear liquid dissolved entirely in a little hydrochloric acid, so that the precipitation could not have arisen from any sulphuric acid having been carried over. The precipitate dissolved in the muriatic acid did not reappear on the addition of ammonia; it consisted therefore of carbonate of baryta. I have repeated this experiment three times, and always with the same result; so that I think I am justified, from the above experiments, in retaining my former opinion, that carbonates do occur in the blood.

CHEMICAL EXAMINATION OF THE BARK OF THE ROOT OF LAURUS SASSAFRAS.*

BY H. REINSCH.

The author found, in 1000 parts, 90 parts water; in the etherial extract, a heavy essential oil, a light essential oil, and a substance resembling camphor—together, eight parts; a substance resembling stearine, eight parts; balsamic resin and wax, fifty parts. In the alcoholic extract—sassafrid, ninety-two parts; tannic acid, fifty-eight parts. In the spirituous extract—sassafrid, tannic acid and gum, sixty-eight parts. In the extract prepared with cold water—albumen, six parts; gum, red colouring principle and salts, thirty parts. In the extract with boiling water—starch, reddish-brown colouring substance, tannic acid and salts, fifty-four parts. In the extract with solution of potash—starch, tannic acid, &c., 289 parts; and vegetable fibre, 247 parts.

Of the two essential oils, the light one, which smelt strongly of sassafras, distilled over first; the heavy one possessed an odour intermediate between fennel and camphor, and a burning aromatic taste.

The sassafrid separated on treating the alcoholic extract with water; it forms, when deposited from spirit, yellowish-brown crystalline granules; rubs off like indigo, is void of odour, and has scarcely any taste. When heated in a platinum crucible, it becomes inflated, with evolution of a peculiar, disagreeable, irritating odour, and burns with a luminous flame to a cinder, which is not very easily reduced to ash. On distillation it first melts, and then evolves a white vapour, which condenses, along with some fluid in the recipient, in the form of a white powder, which gives a greenish-blue precipitate with a solution of peroxide of iron. Nitric acid forms with it oxalic acid, and a considerable quantity of an oily body. Sassafrid dissolves but sparingly in cold water, somewhat more in water containing tannic acid, but readily in boiling, to a light reddish-brown liquid, which becomes turbid on cooling. The hot spirituous solution is of a dark reddish-brown colour, and deposits on cooling a yellowish crystalline powder, and on the addition of water a reddish-brown amorphous powder, which on drying becomes paler. It dissolves but sparingly in ether, forming a light yellow solution. Carbonate of potash produced, in a concentrated solution of sassafrid, which had been prepared with the assistance of heat, a bright red transparent liquid; an-

* Buch. *Rep.*, xxxix. p. 180., and *Chem. Gazette.*

monia the same, but gradually becoming brownish red; it yielded with barytic water a carmine-red precipitate; with lime-water, after some time, carmine-red flakes; with chromate of potash, an abundant dark reddish-brown precipitate; with tincture of iodine, a considerable flocculent yellow precipitate; with peracetate of iron, a dark greenish-brown turbidness. Acetate of lead produced a quantity of white flakes; acetate of zinc, a slight turbidness; acetate of copper, a light brown flocculent precipitate; nitrate of silver, a faint opacity. Dilute sulphuric and nitric acid coloured the solution brighter; tincture of galls and prussiate of potash produced no alteration. According to these characters, sassafrid, which is contained in large quantity in the bark, would range near the astringent acids.

The wood of the root contains similar constituents to the bark, but in far less quantity.

ON THE PREPARATION OF HYDROSULPHOCYANIC ETHER.*

BY M. LŒWIG.

When a concentrated solution of sulphocyanide of potassium is saturated with hydrochloric ether, chloride and hydrosulphocyanic ether are obtained. The reaction takes place very slowly; the rays of the sun, however, hasten it. As soon as it is terminated, the liquid is diluted with its volume of water and distilled; the distilled product is then mixed with twice its volume of pure ether, and sufficient water added to separate the ether holding in solution the new hydrosulphocynic ether. These two bodies are separated by distillation, and the latter rectified over chloride of calcium.

Hydrosulphocyanic ether forms a colourless liquid, with highly refractive powers, tastes like aniseed, and has a penetrating odour similar to that of mercaptan. At 59° it has the same density as water; it likewise boils at about 212°. It may be boiled for some time with a solution of caustic potash without decomposition resulting; but with a boiling alcoholic solution it disengages ammonia as well as bisulphuret of ethyle. On evaporating the alcoholic solution, a considerable quantity of carbonate of potash is obtained, without any trace of sulphocyanide. If however an alcoholic solution of sulphuret of potassium be mixed with this ether, there is produced, especially on the application of heat, sulphuret of ethyle and sulphocyanide of potassium. The presence of this latter is proved on evaporating the liquid, and dissolving the residue in water, which then gives the characteristic reaction of the sulphocyanides with persalts of iron.

The alcoholic solution of the new ether is not precipitated by metallic solutions. Nitric acid decomposes it with violence, but only a very small quantity of sulphuric acid is formed. It contains, according to M. Lowig, $C^6 H^5 N S^2$.

* Poggendorff's *Annalen*, lxvii. p. 101, *Chem. Gazette.*

ON THE VOLATILE OILS ON SEVERAL CRUCIFEROUS PLANTS.*

BY F. PLESS.

The investigations of Wertheim on the connexion existing between oil of garlic and oil of mustard (sulphuret of allyle and sulphocyanuret of allyle), and the well-known fact that most of the Cruciferæ are characterised by acrid volatile substances, led me to suppose that there might be a plant in which these two compounds of allyle might coexist. During last autumn and the present summer I have examined the volatile oils of several of our Cruciferæ, and found at least four distinct bodies in them. As, however, the quantity of substance obtained was very small, it was impossible to submit them to a more perfect examination. I found, however, the idea with which I started confirmed.

OIL OF THLASPI ARVENSE.

When the herb or seed of this plant is pounded, mixed with cold water and distilled, after a time, a colourless oil is obtained, of a peculiar penetrating odour and burning leek-like taste, at the same time calling to mind the oil of garlic and that of mustard. On saturating it with ammonia, subsequently adding water and distilling, the inspissated residue yields beautiful crystals, which prove, from their form, solubility in water and alcohol, bitter taste, melting point at 161°, their mode of decomposition by heat, and their precipitates with solutions of mercury, silver, and platinum, to be thiocinnamine.

On combining the excess of ammonia contained in the distillate with sulphuric acid, the odour of the pure sulphuret of allyle is perceptible, and on redistillation it is obtained pure and colourless. The alcoholic solution of the oil yielded, with chloride of platinum, an orange precipitate, which gave on analysis $C^{24} H^{20} Pt^4 Cl^3 S^9$. This is the double salt of platinum $(Pt Cl^2, C^6 H^5 Cl) + 3 (Pt S^2, C^6 H^5 S)$ described by Wertheim.

It is thence evident that the volatile oil

* *Chemical Gazette.*

contained in Thlaspi arvense is a mixture of oil of garlic and mustard. Neither of the bodies is contained as such in the seed any more than oil of mustard in Sinapis nigra. The powdered seed has not the least odour of either of the two bodies; and when heated to 212° or treated with alcohol, yields no oil on being mixed with water. The alcoholic extract leaves, on evaporation, a crystalline residue mixed with mucilage, which produces, when triturated with water and the seeds of Sinapis alba or S. arvensis, oil of mustard, but no oil of garlic.

Wertheim has already proved the presence of oil of mustard in the root and herb of Alliaria officinalis, and rendered that of the oil of garlic probable; a larger quantity of the two oils is obtained from the seed of this plant by distillation after the action of water. The oil of mustard may readily be freed from that of garlic by the addition of a small quantity of platinum and some alcohol, facilitating the formation of the precipitate by agitation, and then distilling with water. 0·287 grm. of the precipitate left on ignition 0·139 grm. of platinum or 48·4 per cent.

If an excess of chloride of platinum be added, the oil of mustard likewise disappears after some days, and the yellow precipitate then contains a few per cent. more platinum than correspond to the double compound of the oil of garlic.

The mixture of the two oils amounted in my experiments to about 3-5ths per cent. of the seed, of which 9 out of 10 parts consisted of oil of mustard, while this formed only about one-tenth in the mixture of the oil from Thlaspi arvense. This relation, however, of the two oils is not constant in the plants: I found specimens of Alliaria officinalis from a more sunny locality not to contain a trace of garlic oil.

Oil of mustard without garlic oil is also contained in the herb and seed of Iberis amara, and likewise in a very small quantity in the seed of Capsella Bursa pastoris, Raphanus Raphanistrum, and Sisymbrium officinale.

EXPERIMENTS ON GOOSE FAT AND ON OLEIC ACID.*

BY J. GOTTLIEB.

When we submit goose fat to dry distillation, it yields acrolein, it is therefore a glyceride, like other animal fats.

If saponified by means of potash, and treated with an excess of sulphuric acid, in a distillatory apparatus, it yields a slightly acid water, containing small quantities of volatile acids, the smell of which resembles butyric and caproic acid. The residue, after having been pressed between paper, and crystallised in alcohol, yields a fat acid, which melts at 137° F., and consists of a mixture of stearic and margaric acid. The separation of these two acids is rather difficult, still, we may succeed by crystallising the acid in boiling alcohol; stearic acid is first deposited, and margaric acid remains in the mother water. M. Gottlieb analysed it; he also observed an interesting peculiarity in the mixture of these two acids; namely, that it frequently melts below 140° F., that is to say, below the point at which inargaric acid, the most fusible of the two, melts when unmixed: according to his observations—

A mixture of	30	parts stearic acid and	10	parts margaric acid melts at	150½° F.
,,	25	,,	10	,,	149
,,	20	,,	10	,,	147½
,,	15	,,	10	,,	142
,,	10	,,	10	,,	137
,,	10	,,	15	,,	136
,,	10	,,	20	,,	134
,,	10	,,	25	,,	133
,,	10	,,	30	,,	133

OLEIC ACID.

The change this body undergoes when in contact with air, is the cause of the differences pointed out by chemists. M. Gottlieb endeavoured to avoid this change by operating at a low temperature, in a vacuum, or in an atmosphere of carbonic acid.

To obtain oleic acid, in a state of purity, we employ the crude acid, which has been deprived of its concrete fat acids, by means of oxide of lead, and ether: this crude acid, extracted from oil of almonds, goose fat, or butter, contains, in addition to oleic acid, the products of the oxidation of that acid, as well as a brown colouring matter. It is purified in the following manner:—

The acid is mixed with a great excess of ammonia, to prevent the formation of an acid salt, and it is precipitated by chloride of barium. Oleate of baryta is then deposited, possessing the properties indicated by M.

* *Annales de Chimie.*

Varrentrapp. We dry this salt, and boil it with alcohol of a medium strength. The salt then melts and forms a transparent and viscous liquid, a certain portion is dissolved and precipitated, by the cooling of the filtered liquid, in minute crystalline palettes. We repeat this treatment, and crystallise the salt once or twice in alcohol, we obtain it under the form of a white, light, and crystalline powder, which does not melt at 212°. The alcohol retains the impurities which render the crude oleate of baryta so fusible.

To extract the oleic acid ftom the salt thus purified, it is decomposed by means of tartaric acid, and the product is washed in water.

The following is another means of obtaining oleic acid, in a pure state, if we expose the crude acid to a temperature equal to 19° or 20° F., it is formed into a crystalline mass of greater or less consistence. It is only the pure oleic acid that crystallises in this manner, those portions that are already oxidised remain fluid. The mass is pressed between paper, washed with a little alcohol, and again submitted to the action of cold; in this manner the acid is obtained in beautiful and perfectly white needles, it is again pressed between paper, and the operations are repeated, until the pure acid, dried in a current of carbonic acid, melts at 57° F.

The last operation will only succeed with an acid which is not too much oxidised.

Pure oleic acid, in whatever manner it is obtained, forms, at a heat above 57° F., a colourless and limpid liquid, of an oily consistence, without smell or taste, and not reddening turnsol paper, even in its alcoholic solution. At about 39° F., it becomes concrete, forming a very hard crystalline mass; it cannot be distilled without change. In a solid state it does not attract oxygen, but the liquid acid soon oxidises.

Four analyses, that nearly agreed with each other, made upon the acid obtained from olive oil and goose fat, gave the proportions C^{18} H^{34} O^2.

It is scarcely possible to obtain the oleate of silver, the salt being almost instantly reduced.

M. Gottlieb confined himself to the analysis of the oleate of lead, and the oleate of baryta, and he found

C^{18} (H^{33} P6) O^2 and C^{18} (H^{33} Ba) O^2.

To prepare the salt of lead we dissolve pure oleic acid in absolute alcohol, and add an excess of dry carbonate of soda, by gently heating it; the vapour of the alcohol in the glass balloon, prevents the access of air. We heat it to the boiling point, until the liquid becomes decidedly alkaline. We filter it rapidly, dilute it with a little water, and allow it to cool, after covering the liquid. We precipitate the cold solution by neutral acetate of lead, filter it quickly, and wash the white precipitate in a cool place. Oleate of lead, dried in *vacuô*, is a light, white powder, which melts into a yellow liquid at 176° F.

We have already pointed out the means of obtaining pure oleate of baryta.

M. Gottlieb, also, made several experiments on the products of oleic acid when changed by contact with oxygen. These products possessed no decided characters; at the ordinary temperature, oleic acid rapidly absorbs as much as twenty times its volume of oxygen, without losing the least trait of carbonic acid or water; when kept for several hours in contact with air, at 212° F., it turns rancid, and no longer becomes perfectly concrete by cold.

THE FORMATION OF ELAIDIC ACID.

M. Gottlieb's analyses confirm the results already obtained by M. Meyer, which are also of the same description as those most recently published by M. Laurent.

M. Gottlieb, also, analysed the salt of silver, C^{18} (H^{33} Ag) O^2. These formulæ are of the same nature as those of the oleates, and prove that these salts are isomerous with the elaidates.

When pure oleic acid is treated with nitrous acid, it soon concretes into a white and crystalline mass, without showing the least trace of the red substance, which M. Meyer observed to form itself, at the same time, by operating on impure oleic acid; in that case nearly the whole solidifies.

Oleic and elaidic acid have considerable resemblance when concrete; but while oleic acid crystallises in alcohol, in the form of needles, by the application of cold, elaidic acid is separated under the form of large leaflets. Oleic acid does not redden blue turnsol paper, while elaidic acid exhibits a strong acid reaction. Their different points of fusion, also, enable us to distinguish them: finally, the preparation of neutral elaidates is easily accomplished, but, in the case of oleic acid, many difficulties present themselves.

Elaidic acid becomes oxidised, also, in a liquid state, in contact with the air; this oxidation, however, is far from being so quick as in the case of oleic acid, it is, therefore, advisable to keep elaidic acid from the air when we heat it to 113° F.

The conversion of oleic acid into elaidic acid, without change of composition, or of atomic weight, is too isolated a fact to make it possible, for an instant, to give a satisfactory explanation; it is also probable, that it is in consequence of some chemical action exercised by the nitrous acid, on a very small quantity of organic matter, the molecular disturbance of which is communicated to the

remaining oleic acid. At least M. Gottlieb remarked the presence of a certain quantity of ammonia, in the product of the reaction, as well as that of a small quantity of an oily body, formed no doubt at the expense of the nitrous and oleic acids.

The author did not succed in solidifying oleic acid, by the employment of any other substances, excepting nitrous acid, as, for instance, putrefied gluten, chromic acid, &c.

When we keep elaidic acid for a length of time, at the temperature of 147° F., it absorbs a considerable quantity of oxygen, and acquires a rancid and very disagreeable smell, it then liquifies, and can no longer be converted by nitrous acid.

It has been said that margaric acid, dissolved in oleic acid, is, also, converted into elaidic acid, by contact with nitrous acid. This, according to M. Gottlieb, has not proved to be correct.

DRY DISTILLATION OF OLEIC ACID.

When we distil elaidic acid, a great portion of it passes without change, oleic acid, which is isomerous, comports itself differently.

When we distil oleic acid, or fatty substances containing olein, their passes over, in addition to substances known to chemists, perceptible quantities of capric and caprylic acids, which remain in solution in the liquid hydrocarburets. To extract these acids, we agitate the oily product in a tolerably dilute solution of carbonate of soda, so as to fix them, as well as sebacic acid, undecomposed oleic acid, and traces of acetic acid. We rapidly evaporate the saline solution, to separate from it, as much as possible, the hydrocarburets, when it is sufficiently concentrated. We distil it in a retort, along with tartaric acid; the fat, volatile, acids then pass over; we combine them with baryta, and operate according to the directions of M. Lerch.

M. Gottlieb analysed the caprate of baryta, obtained in this manner, C^{10} (H^{19} Ba) O^2, as well as the salt of lime.

The mother waters yielded caprylate of baryta, C^8 (H^{19} Ba) O^2, which was analysed, as well as the salt of silver.

Besiding the preceding salts, the remaining mother waters yielded small quantities of other salts, among which the author suspected the presence of a valerate and butyrate, judging by the smell.

Pure oleic acid yields a considerable quantity of sebacic acid, by dry distillation, as well as capric and caprylic acid, particularly the latter. But, in proportion as the oleic acid is changed in the air, it loses the property of yielding these products; on this account M. Bromeis was unable to obtain sebacic acid, by the distillation of the oleic acid of butter.

The result of these experiments of M. Gottlieb is, that this acid is identical with that of goose fat, and olive oil, and that it is only after it has been considerably changed by its contact with air, that it exhibits the various characters pointed out by M. Bromeis.

MILK OF THE COW TREE.

An analysis of this vegetable milk, afforded by M. Heintz the following result: water 57·3, vegetable albumen 0·4, a species of wax (having the formula C^{35} H^{66} O^5) 5·8, a resin soluble in cold or boiling alcohol (corresponding to the formula C^{26} H^{28} O^2) 31·4, gum, and a kind of sugar 4·7, bases resisting the action of heat, such as magnesia, soda, traces of potash and lime combined with phosphoric acid, and an organic acid undetermined 0·4 = 100. This agrees nearly with the analysis of MM. Boussingault and Mariano; but differs so much from that by M. Marchand, that M. Heintz suspects he may have examined the milk of another species of plant.

EXPERIMENTS ON GLUCOSE AND FRUIT SUGAR.*

BY M. SOUBEIRAN.

FRUIT-SUGAR was never clearly distinguished from other kinds of sugar, until M. Biot showed that it possessed peculiar optical properties. It has a rotatory power towards the left; instead of deviating from the plane of polarisation towards the right, as cane sugar, glucose, &c., &c. This description of sugar does not crystallise, although it may be rendered solid by careful evaporation, it is infinitely less stable than glucose; while a solution of glucose resists, with extreme tenacity, the prolonged action of heat, fruit-sugar is more easily changed than even cane-sugar. This change is shown by the constantly increasing discoloration of the liquid, and by an alteration in its rotatory power, which, from a direction towards the left, in the first instance, goes on gradually decreasing, until it ceases, and afterwards moves towards the right.

Fruit-sugar may be rendered solid without losing its rotatory power towards the left. For the purpose of converting it, a regular aggregation must be produced by crystallisation. The following are some of the experiments I made on this subject.

I. Fruit-sugar was rendered solid by evaporation in a water-bath; by redissolving it in water, it exercises a deviation towards the

* *Journal de Pharmacie*, May, 1846.

left, as before; this fact has also been established by M. Mitscherlich.

II. Fruit-sugar was precipitated by ammoniacal acetate of lead. The precipitate that is formed was washed, to deprive it of any sugar that might still adhere to it; it was then submitted to the action of a current of sulphuretted hydrogen, which separated the lead. Fruit-sugar was found in the liquid, with a rotation towards the left.

III. Fruit-sugar was treated as before, but the lead precipitate was dried, before decomposing it by means of sulphuretted hydrogen, and the result was the same.

IV. An alcoholic solution of caustic potash was mixed with an alcoholic solution of fruit-sugar, a glutinous compound of potash and sugar was separated. This compound, after having been washed several times in alcohol, and placed in alcohol containing a small quantity of sulphuric acid, precipitated sulphate of potash, and the alcohol retained in solution, sugar, with a rotation to the left.

V. Sea-salt was dissolved in the syrup of fruit-sugar, and the liquid was set by, in a well-aired, dry apartment. At the end of a few months regular crystals were produced, resembling those obtained from glucose; these crystals had a rotatory power to the right. Directly the crystallisation takes place, fruit-sugar becoming a constituent part of a crystallised substance, has its molecular condition changed, and its rotatory power is at the same time altered. This experiment is extremely curious. Nothing shows that chemical combination has taken place between the sugar and the salt; at any rate its constitution is changed at the moment of crystallisation, because the crystals contain glucose.

ANALYSES OF FRUIT-SUGAR.

I know of only one experiment on the composition of fruit-sugar, for which we are indebted to M. Mitscherlich, who found that this description of sugar, dried at 212°, is represented by the formula $C^{24}\ H^{24}\ O^{24}$. This combination gives 40 per cent. of carbon and 60 per cent. water. I have made three analyses of uncrystallisable sugar, which I obtained by acting on cane-sugar by sulphuric acid; the analyses yielded me—

C	4·02	40·4	39·3
HO	60·8	59·6	60·7.

COMPOUNDS OF LEAD, AND GLUCOSE, OR FRUIT-SUGAR.

I precipitated a solution of fruit-sugar by ammoniacal oxide of lead, and I found 73 per cent. of oxide of lead in the product, when dried in a vacuum. This demonstrated a very great difference between this compound and that formed by M. Peligot, with glucose. Still, however, as glucose, melted at 212° F., has the same constituents as fruit-sugar dried at the same temperature, and as my own experiment confirmed this result, I was induced once more to examine the various combinations of glucose. Now, all the analyses I made of the compounds of oxide of lead, and glucose, dried at 212°, have always yielded me from 74 to 75 per cent. of oxide of lead. I usually employed 20 parts of glucose, 35 of crystallised acetate of lead, 400 of water, and 25 of liquid ammonia. As only 66 per cent. of oxide has been acknowledged in plumbic glucose, to discover the cause of this difference I varied the different methods of precipitation, and the quantity of ammonia; but I always found the number to be from 74 to 75 per cent. of the base. I satisfied myself that acetate of ammonia could not, of itself, produce a precipitate in the time necessary for the perfecting the plumbic sugar. I mixed the solution of glucose with neutral acetate of lead, then I added ammonia diluted with water, by small quantities at a time, but I stopped as soon as the ammonia no longer produced a precipitate in the liquid. The compound produced under these circumstances, still contained the same quantity of oxide of lead.

The compound of glucose and lead, first dried in a vacuum, at 212°, yielded—

C	12·3	12·0	11·9
HO	12·4	12·5	12·1

The compound of fruit-sugar and lead, gave—

C	12·00	11·7
HO	11·96	12·3

These results conducted us to the following formulæ:—

C	22 Pts.	1800	12·2
HO	16 Pts.	1800	12·2
Pb O	8 Pts.	11156	75·6
		14756	100·0

COMPOUNDS OF LIME AND GLUCOSE, OR FRUIT-SUGAR.

I prepared a combination of lime and glucore, and lime and fruit-sugar, by mixing a solution of these sugars with lime and water, and then filtering; adding a small quantity of sugar to saturate the lime, that might be in excess, and precipitating it by alcohol. One of these compounds of fruit-sugar and lime, converted into sulphate of lime by means of sulphuric acid, yielded 23·5 lime, another gave 23·78, and another 23·5 of the same base.

In the case of the analysis of the compounds of lime, glucose or fruit-sugar, dried in a vacuum, the results varied considerably. I obtained—

C	29·	28	28·5	29·	28
HO	48	49	49·5	48	47

One portion of these results agreed tolerably well with the formula.

C.... 24 Pts.	1800	28·24
HO.. 28 Pts.	3150	49·42
Lime.. 4 Pts.	1424	22·34
	6374	100·00

While endeavouring to discover the cause of these variations, I ascertained that they arose from the difficulty of bringing these compounds to a fixed state of desiccation. At one time, if we weigh these compounds, 24 or 28 hours after they were placed in a vacuum, we find that their weight has not sensibly changed; but, if left for a greater length of time, we soon discover that they have lost still more water, but very slowly indeed. It will be sufficient to say that I was obliged to leave a few grammes of these combinations of lime for three months in a vacuum, so as to bring them to that state in which they could no longer lose weight by desiccation. There is a certain quantity of the water which is only separated by slow degrees. When not aware of this circumstance, we analyse substances which are not combined with water, to the same extent, as if they were identical.

The compound of glucose and lime which had remained in a dry vacuum, until it ceased to lose weight, gave

HO.. 45·85	45·16
C.... 30·5	30·00

4 parts of water had therefore been removed, and the compound was reduced to the formula,

C^{24} HO^{24} CaO^{4}.

C..... 24 Pts.	1800	30·3
HO .... 24 Pts.	2701	45·7
Ca O ... 4 Pts.	1424	24·0
	5925	100·0

COMPOUND OF GLUCOSE AND BARYTA.

The compound of glucose and baryta is so soon changed that, according to M. Peligot, it can only be obtained by the employment of wood-spirit.

According to this chemist, it is composed of

C ..... 24 Pts.	23·0
HO .... 28 Pts.	40·3
Ba O ... 3 Pts.	36·7
	100·0

But M. Peligot's analyses have in reality given sufficiently discordant numbers, viz., 19 to 27 of carbon, and 37 to 13 of water. I found the case no better in my first experiments. But I might have been able to admit M. Peligot's formula, which agrees, tolerably well, as this chemist expresses himself, with the results of the analyses. These variations partly depend on the wood-spirit, which it is very difficult to get rid of entirely, but more particularly on the fact that this compound of baryta, like that of lime, loses its constituent water very slowly; and that it is impossible to tell the moment when all the hygrometrical water is evaporated and the constituent water has not as yet begun to be dissipated. The real proportion of water cannot therefore be determined with precision, and the experiment will agree as well with the theory, if we admit 29 of water instead of 28. I said, that I found it more convenient to prepare the compound of baryta directly from glucose and baryta, I employed an excess of sugar, and precipitated it by means of alcohol, and I quickly washed the precipitate. I then rapidly dried it, in a vacuum, at first over lime, and afterwards over sulphuric acid.

The compound of baryta, after remaining nearly three months in a dry vacuum, was analysed by means of chromate of lead; it gave a per centage of—

C.... 24·8	25·0	
HO.. 39·0	38·6	

and yields this formula—

C.... 24 Pts.	1800	24·41
HO.. 24 Pts.	2701	36·62
Ba .... 3 Pts.	2874	38·97
	7375	100·00

THE COMPOUND OF GLUCOSE AND SEA SALT.

I analysed some beautiful crystals of sea salt and glucose, extracted from honey, M. Peligot obtained similar compounds, 13. 13·2, 12·8, and 13·1 per cent. of sea salt. I found 13·3 per cent.; but as the whole question reduces itself to the discovery of one atom of water more or less in this compound, the determination of the chlorine will satisfy both these suppositions. I had recourse to the same process as in organic analysis, by taking every necessary precaution to determine the water with the greatest precision. I obtained the following results:—

Substance dried in a vacuum.

0·628 = HO	337	53·6 per cent.
0·597 = HO	319	53·5 per cent.

Substance dried at 212° F.

1·005 = HO	52·2	51·9 per cent.
1·000 = HO	52·0	52·0 per cent.
1·069 = HO	56·8	51·2 per cent.

This compound of sea salt and glucose, dried at 212° F., was constituted as follows:—

C.... 24 Pts.	1800	34·4
HO.. 24 Pts.	2701	51·6
Salt.., 1 Pt.	733	14·0
	5234	100·0

The same compound dried in a vacuum, agrees with the following formula:—

C.... 24 Pts.	1800	32·98
HO.. 26 Pts.	2925	53·61
Salt.... 1 Pt.	733	13·41
	5458	100·00

It is proper to observe, that I could find no more than 50·9 and 51·2 of water in a portion of the water which had remained for a length of time in a dry vacuum, and that, consequently, a temperature of from 212° to 267° F. is not absolutely necessary to drive out the 2 parts of the water in excess. This fact throws a small doubt upon the true proportion of water in the hydrated compound. It is, perhaps, impossible to mark the precise moment when it no longer contains hygrometrical water, and when it has not as yet lost its constituent water. This observation is of great import—for if we admit 54·5 per cent. of water, instead of 53·6, (that is to say, 27 parts instead of 26,) the compound will completely harmonise with other combinations of glucose.

It results from the experiments described in this paper.

1st. That the conversion of fruit-sugar into glucose is not due to the solidification of the first of these sugars, and that it only manifests itself under circumstances in which other sugars crystallise.

2nd. That glucose and fruit-sugar, dried at 212°, possess the same chemical composition.

3rd. That the compounds of the two kinds of sugar, with bases, are composed in the same manner.

4th. That the molecule of glucose, or of fruit-sugar, is represented by C^{24} HO^{24}. The bases are here combined by the displacement of water.

The following are the series of these combinations:—

Sugar	C^{24} HO^{24}
,, hydrated	C^{24} $HO^{24}+4$ HO^{4}.
,, with lime	C^{24} $HO^{24}+4$ Ca O.
,, with lime and hydrated	C^{24} $HO^{24}+4$ Ca O + HO^{4}.
,, with baryta	C^{24} $HO^{24}+3$ Ba O, HO.
,, with baryta and hydrated	C^{24} $HO^{24}+3$ Ba O, HO + 3 or 4 HO.
,, with sea-salt	C^{24} HO^{24} + Na Cl 3HO.
,, with lead	C^{24} HO^{16}, Pb O^{8}.

Two elements, alone, of this series are not established by an indisputable experiment. It is doubtful whether the constituent water of the compound with baryta is 3 or 4 parts—a matter of little interest, but it is also undecided whether the compounds of sugar and sea-salt contain 53·6 or 54·5 water. I have admitted the latter hypothesis to be as probable as the former. One fact appears to me to be more singular—namely, that sugar takes up only 3 parts of baryta, while it instantly combines with 4 parts of lime, and we are obliged to admit this by the results of numerous experiments.

The preceding series is so far remarkable, that the 4 parts of water which belong to crystallised glucose, and probably to fruit-sugar, are replaced by 4 parts of lime or other body. The water lost in the vacuum, by sugar and lime, and sugar and baryta, is certainly additional.

When sugar combines with oxide of lead, it takes up 8 parts of water, but it also loses 4 parts. It is not changed, for we can extract it with all its properties by destroying the combination by means of sulphuretted hydrogen, or sulphuric acid. Taking this compound of lead as a type, we should have the following series, in which 1 part of sugar would be united to 8 parts of the base:—

Sugar in combination with lead	C^{24} HO^{16}
,, dried at 212°	C^{24} $HO^{16}+HO^{8}$
,, and lead	C^{24} HO^{16} + Pb O^{8}
,, and lime	C^{24} HO^{16} + HO^{4}, Ca O^{4}
,, and baryta	C^{24} HO^{16} + Ba O^{3} HO^{5}
,, and sea-salt	C^{24} HO^{16} + HO^{7} Salt

NEW TEST FOR PRUSSIC ACID.*

The following new method of testing hydrocyanic acid is proposed by Mr. Richard Austin, jun., of this city. The precipitate of cyanide of silver, say half a grain, obtained in the usual manner, is mixed with a small quantity of oxide of iron and carbonate of potash, and the whole fused together in an iron or platinum capsule. The fused mass is then dissolved in half an ounce of distilled water, filtered, and rendered slightly acid by the addition of a few drops of hydrochloric

* *Dublin Hospital Gazette.*

acid. The liquid thus treated is next divided into two portions, to one of which a few drops of a solution of sulphate of copper is added, which immediately causes the evolution of the chocolate-brown colour, so characteristic of the ferrocyanide of copper; and to the other a few drops of the muriate tincture of iron, or any persalt of iron, when the solution becomes intensely blue by the formation of the ferrocyanide of iron, the ordinary Prussian blue.

In Mr. Austin's opinion, "these two tests, with the well-known odour of prussic acid, are, independent of all others, sufficient to convince the medical jurist of the presence of free prussic acid." Mr. Austin adduces several arguments to show the superiority of this test over those already known to chemists, both in accuracy and facility of application, by persons not skilled in chemical manipulation.

The precipitates above mentioned are very distinctly obtained with half a grain of cyanide of silver.

ON A NEW PROCESS FOR OBTAINING PURE CHLORINE GAS.*

BY PROFS. R. E. ROGERS, AND W. B. ROGERS.

THIS process is founded on the powerful oxidating action of chromic acid, especially when liberated in a solution, and consists in causing a reaction between hydrochloric acid and this substance, in which the chlorine of the former is set free. Our mode of proceeding is as follows :—

To 1 part of powdered bichromate of potassa, in a small retort or flask, we add 6 parts of hydrochloric acid, of specific gravity about 1·16, and apply a gentle lamp-heat for a few seconds, so as to bring about a brisk reaction. The chlorine is now rapidly evolved, and continues to be disengaged as fast as is convenient, without requiring any further application of the lamp.

Referring to the composition of the bichromate of potassa and of hydrochloric acid, it will be seen that one equivalent of bichromate of potassa and seven hydrochloric acid, are capable of evolving three equivalents of chlorine, at the same time giving rise to one equivalent of the sesquichloride of chromium, one of the chloride of potassium, and seven of water.

In order to ascertain how near we might approach to the equivalent quantity of chlorine above deduced, we resorted to the following method. Knowing that a strong solution of chloride of sodium is much less absorbent of the gas than ordinary water, we prepared a quantity of saturated brine, through which we passed chlorine, until the liquid appeared to be fully charged. With this we filled a tall graduated vessel, designed to receive the gas, and a porcelain bowl, which served as a pneumatic trough, and having placed 4 grammes of the bichromate with an excess of hydrochloric acid in a small retort, we passed the gas as it was evolved, through the chlorus saline solution into the narrow graduated jar. After urging the process until the action entirely ceased, and no further gas escaped, we measured the resulting gas with the usual precautions, at 60°. Its volume was found to be 54·5 cubic inches. On repeating the experiment with the same amount of bichromate and acid, and with the same brine, we obtained in the second trial 55·5 cubic inches, and in the third 56·2 cubic inches of the gas, the increase being evidently due to the diminished absorption arising from the more complete saturation of the liquid with chlorine.

Taking 76·5 grains as the weight of 100 cubic inches of chlorine, at 60° F., the volume due to the entire decomposition of 4 grammes of bichromate of potassa, is 57·3 cubic inches. It thus appears that with proper precaution, this process may be made to yield 56-57ths, or nearly the whole theoretical amount of the gas.

* *Silliman's Journal.*

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

EXPERIMENTS TO DETERMINE THE EFFECT OF BARLEY AND MALT ON THE MILK OF COWS, AND THE FATTENING OF BULLOCKS.*

BY THOMAS THOMSON, M.D., AND R. D. THOMSON, M.D.

(*Continued from page* 324.)

THE next subject which is taken up is the nature of grass and hay as food. The ultimate analysis of hay, made by Dr. Will, at Giessen, by M. Boussingault, at Strasburgh, and by Dr. Thomson, at Glasgow, is given in the following table:—

Carbon.....	45·87	45·80	45·41
Hydrogen ..	5·76	5·00	5·93
Nitrogen....	41·55	1·50	1·84
Oxygen		38·70	39·21
Ash	6·32	9·00	7·61

Grass, it appears, is more available for the purpose of being converted into hay when it is cut before it has run to seed, as otherwise it contains a predominance of woody matter over the soluble principles, and is consequently less suitable to serve as food for animals than substances capable of assuming the solid condition. The second point of importance in haymaking is to dry the grass under such circumstances as to retain the soluble proportion in its integrity. To ascertain whether hay, by the processes and exposure which it undergoes, loses any of its soluble constituents, the following experiments were made:—

1st. 3,000 grains of rye grass in seed, on the 13th July, gave up to hot water a thick syrupy fluid, which, when dried till it ceased to lose weight at 212°, weighed 217·94 grains equivalent to 7·26 per cent.

2nd. 2,500 grains of rye grass, digested in cold water, yielded 53·23 per cent. grains of extract, equal to 2·12 per cent. This rye grass contained 31 per cent. of solid matter, and 69 per cent. of water.

3rd. New hay, made from rye grass, and containing 20 per cent. of water, for the sake of comparison, was also subjected to similar trials.

Grains.	Grains of Extract.	per cent.
1st. 1.369 gave to hot water	220·77	16·12
1,000	159·34	15·93
1,000	140	14

2nd. 2,000 grains of hay, new, in seed, digested in cold water yielded 101·3 grains of extract = 5·06 per cent. of soluble matter.

From these numbers we learn that 100 parts of hay are equivalent to 387½ of grass. This amount of grass should contain of soluble matter in hot water 28·13 parts, and in cold water 8·21 parts. But the equivalent quantity of hay, or 100 parts only, contains 16 instead of 28 parts soluble in hot water, and 5·06 instead of 8¼ parts soluble in cold water. A very large proportion of the soluble matter of the grass has obviously disappeared in the conversion of grass into hay. The result of the haymaking in this particular instance has, therefore, been to approximate the soft, juicy, and tender grass to woody matter by washing out or decomposing its sugar and other soluble constituents. These facts enable us to explain the reason why cattle consume a larger amount of hay than is equivalent to the relative quantity of grass. Thus animals which can subsist upon 100 lbs. of grass should be able to retain the same condition by the use of 25 lbs. of hay, if the latter suffered no deterioration in drying. The present series of experiments show that a cow, thriving on 100 to 120 lbs. of grass, required 25 lbs. of hay, and 9 lbs. of barley or malt, affording thus collateral evidence of the view which we have taken of the imperfection of the process of haymaking at present in use in this country.

The great cause of the deterioration of hay is the presence of water, either from its incomplete drying, or from its absorption from the atmosphere. This leads to fermentation, and the conversion of the sugar contained in hay into alcohol.

The action necessary for decomposing the sugar is induced by the presence of the albuminous matter of the grass; the elements of the sugar are made to react on each other in the moist state in which they exist, in consequence of the presence of the water and oil, and are converted into alcohol and carbonic acid, according to the following formula:—

	Carb.	Hyd.	Oxy.
1 Atom sugar	12	12	12
2 Atoms alcohol.....	8	12	4
4 Atoms carbonic acid..	4	0	8

That alcohol is produced in a heated haystack, in many cases, may be detected by the

* *Medical Gazette.*

similarity of the odour disengaged to that perceptible in a brewery.

Hay contains from 14 to 20 per cent. of water, capable of being removed at the temperature of 212°: in the best new made hay, the average quantity present is 20 per cent.

When it contains as much as this it is very liable to ferment, especially if it should happen to be moistened by any accidental approach of water. The only method which we have found to succeed in preserving grass perfectly entire is by drying it by means of artificial heat. Rye grass contains, at an early period of its growth, as much as 81 per cent. of water, the whole of which may be removed by subjecting the grass to a temperature considerably under that of boiling water; but, even with a heat of 120°, the greater portion of the water is removed, and the grass still retains its green colour, a character which appears to add greatly to the relish with which cattle consume this kind of provender. When this dried grass (as it may be truly termed by way of distinction from hay) is examined, it will be found to consist of a series of tubes, which, if placed in water, will be filled with the fluid, and assume in some measure the aspect of its original condition. In this form cattle will eat it with a relish, and prefer it to hay, which, in comparison, is blanched, dry, and tapless. The advantages attained by this method of making hay, or rather of preserving grass in a dry state, are sufficiently obvious. By this means all the constituents of the grass are retained in a state of integrity; the sugar by the absence of water, is protected from undergoing decomposition, the colouring matter of the grass is comparatively but little affected, while the soluble salts are not exposed to the risk of being washed out by the rains, as in the common process of haymaking. The amount of soluble matter capable of being taken up by cold water is, according to the preceding trials, as much as 5 per cent., or a third of the whole soluble matter. Therefore, some notion may be formed of the injury liable to be produced by every shower of rain which drenches the fields during hay harvest. It is not only, however, the loss which it sustains, in regard to the sugar and soluble salts, that renders hay so much less acceptable than grass to the appetite of cattle. The bleaching which it undergoes in the sun deprives it of the only peculiarity which distinguishes one form of fodder from the other; grass deprived of its green colouring matter presents exactly the appearance of straw, so that hay ought to be termed grass straw. It is obvious, from the experiments detailed, that the operation of haymaking, as conducted in this country, has a tendency to remove a great proportion of the wax in the grass. Thus it was found that rye grass contained 2·01 per cent. of wax. Now as 387½ parts of rye grass are equivalent to 100 parts of hay, and as 387½ parts of grass contain 7·78 parts of wax, it is obvious that 100 parts of hay should contain the same amount of wax; but by experiment it was found that 200 grains of hay contained 4 grains of wax, which is equivalent to 2 per cent. almost exactly the amount contained in grass. Hence it appears that no less than 5·28 grains of wax have disappeared during the haymaking process. The whitening process which the grass undergoes in drying renders it apparent that the green colouring matter has undergone change; but that it should have been actually removed to such an extent, or at least have become insoluble in ether, is a result which could scarcely have been anticipated without actual experiment.

In the neighbourhood of manufacturing towns there could be no difficulty in preparing abundance of hay by the process now recommended. The waste heat of the chimnies might be sent through apartments or sheds of almost temporary construction guided by a proper draught, so as to carry off the vapour as soon as it is volatilised; and the same arrangements might, with economy, be adopted in conjunction with brick and tile works. Haymaking would thus commence at much earlier period of the season, the grass would be cut, carted to the drying-room, and in the course of a few hours be ready for stacking. When hay prepared in this manner is to be given to cattle and horses, it may be steeped in a tank for twenty-four hours, or any adequate period, before being placed in the racks and boxes; and the steep water, which will contain sugar and soluble salts, should be given to them to drink.

By this system of preserving grass, we have in winter this summer food, which all admit to be superior to every other substitute; and while the animals themselves would be benefited, much uneasiness and trouble in winter would be saved to the farmer.

The constituents of the rye grass, washed out by rain, would be principally the sugar and soluble salts. The nature of the inorganic salts, both of the stem of the grass, when dried as hay, and of the seeds, is as represented in the following tables.

100 parts of the stem and seeds were compared as follows:—

	Stem.	Stem.	Seed.
Water	15·30	19·30	11·376
Organic matter	79·52	75·72	82·548
Ash	4·98	4·98	6·070

Table of saline matter in stem and seeds of lolium perenne.

	Stem.	Seed.
Silica	64·57	42·28
Phosphoric acid ..	12·51	18·89
Sulphuric acid ..	—	3·12
Chlorine	—	trace.
Carbonic acid	—	3·61
Magnesia	4·01	5·31
Lime	6·50	18·55
Peroxide of iron ..	0·36	2·10
Potash	8·03	4·80
Soda	2·17	1·38

A comparison of the two columns of this table adds another argument to that already brought forward against the practice of allowing rye grass to come to seed before cutting it for hay, since the seed tends to remove a much larger portion of phosphoric acid from the soil then the stem; the quantity of this acid found in the seed exceeding that in the stem by one third. A similar observation, with greater force, applies to the lime, as the amount of this earth is two-thirds greater in the seed than in the stem. The quantity of alkalies is twice as great in the stem as in the seed, while the total ash of the seed is a sixth part superior in amount to that of the stem.

The second set of experiments was made by feeding the cows with entire barley soaked in boiling water, and although by calculating the value of the barley as a nutritious body from the nitrogen contained in it; it was foune that two and a half pounds of barley contain as much albuminous nutriment as ten pounds of grass, yet the result showed that the conditions of the trial were not such as to prevent the animals from falling off both in milk and weight. The true reason of this failure Dr. Thomson thinks was that the digestion of the barley was in some degree prevented by the want of power in the animal organs to rupture the husk of the grain. The result of the experiment, he says, demonstrates the importance of a certain amount of cookery in feeding cattle which are possessed of teeth in one jaw only. The next experiment was made with entire malt soaked in boiling water. The result was that the brown cow fell off in the amount of butter during the first five days, but increased during the remainder of the trial. The white cow gave a larger quantity of butter with malt than barley. The milk of both cows increased very considerably, while the weight of the brown cow, which had decreased with the barley experiment, began to increase under the influence of the malt. From the results of this experiment, the advantage of having a large portion of the food readily soluble and administered into the stomach of animals in that condition may be inferred. The amount of butter would appear to depend more upon this provision than upon the quantity of matter soluble in ether existing in the food. The fourth and sixth experiments were made with crushed barley steeped in boiling water, the only difference being that a larger quantity of barley was given in the sixth than in the fourth experiment. In the fifth crushed malt digested in boiling water was given. The comparative results of these experiments give—

I. Milk.

100 lbs. of mixed barley, hay, and grass produced 8·17 lbs. milk.

100 lbs. of mixed malt and hay produced 7·95 lbs. milk.

II. Butter.

100 lbs. barley, hay, and grass, produced 1·95 lbs. butter.

100 lbs. malt and hay produced 1·92 butter.

III. Weight of Cattle.

		Gain.	Loss.
Weight of cattle before barley experiment ..	2022	—	—
After do.	2111	80	—
After malt	2069	—	42

According to this view of the experiment it appears that the malt produced a smaller amount of milk and butter when combined with hay than in the barley experiment, and that the cattle were losing weight, and consequently strength, daily; while with barley they were gaining weight daily. In whatever manner, therefore, we view the experiments, this is an insurmountable objection to the use of malt—that it is not capable when used in any quantity, comparatively with barley, to sustain the weight and consequent strength of animals. But there is another aspect in which the experiment should be examined, and this is obviously the correct one, since a larger quantity of malt was used than of barley. If hay is considered a constant quantity, and then the amount of product which would comparatively result from each grain is calculated, the consequences would be as follows:—

I. Milk.

100 lbs. of barley would produce, 34·6 lbs. dry milk.

100 lbs. of malt would produce, 26·2 lbs. dry milk.

II. Butter.

100 lbs. of barley would produce 7·66 lbs. butter.

100 lbs. of malt would produce 0·35 lbs. butter.

By the present mode of comparison, then, it appears that in every point of view, malt is inferior to barley as an article of diet for

cattle, as it gives less milk and butter, and diminishes the live weight, instead of increasing it, which barley does under the same circumstances.

These results naturally led to a comparison of the chemical nature of barley and malt. The soluble salts are much diminished in the malt, and hence a larger quantity of the grain would be required than of barley to produce the salts of a given amount of milk. The quantity of nitrogen is inferior to that of the barley, and hence malt must be inferior in nutritive agency to the barley in comparing equal weights, while the quantity of sugar being greater, the amount of butter produced might be equal or nearly so to that found from barley, as is observable in some of the experiments.

The following are the effects of the process of malting:—

The analyses which show the chemical difference between barley and malt, just alluded to, afford some information in reference to the process of malting, and to the change which the barley undergoes in this operation. One of the most striking alterations produced in the barley by its being steeped in cold water for forty hours and upwards, is to diminish its weight. Equal volumes or measures of barley and malt were found respectively to weigh 424 and 425 grains. This would give 100 parts by weight of barley, equivalent to 76·65 of malt; but as barley expands slightly or increases in bulk by steeping and convertion into malt, the difference between the two conditions is scarcely so considerable. In three returns obtained from maltsters, it was stated that—1st, 27 cwt. of barley becomes 22½ of malt, or equivalent to 100 barley, and 83¾ malt; 2nd, a bushel of barley weighing 55 lbs. becomes when malted from 43 to 45 lbs., or equal to 100 barley, and from 78·2 to 82 lbs. malt; 3rd, a bushel of barley weighing 55 lbs. becomes 43 lbs. when malted, or as 100 to 78·2. The mean of all these indicates a loss which the barley sustains by malting of 19 per cent., and upwards, or the loss might be taken approximately at 20 per cent., or one fifth. The whole of this loss is not, however, solid matter, for, according to our trials, barley when not crushed contains 13·1 per cent. of water, and malt in the same condition 7·06 per cent. of water, capable of being dissipated at the temperature of 212°. Hence, of the 19 per cent. of loss sustained by the barley in malting, 6 per cent. is water. There thus remain, therefore, only 13 per cent. to be ascribed to solid loss. The quantity of saline matter removed from the barley is considerable. A mean of several trials gives, for the ash of barley, 3 per cent., and for that of malt 2·52 per cent. Now, as 100 barley are equal to 80 malt, the quantity of ash which malt should contain is 2·42, if the loss of inorganic and organic matter are equable, which is observed to be almost approximately, from this experiment; for the relation of the ash which has disappeared, or 0·48 per cent. of ash, and 12·52 of organic matter, and by calculation we have—

As 3 : 0·48 : : 84 : 13·4,

a remarkable coincidence, as if proving that water is incapable of removing the ash of plants until the organic matter has undergone such a change as to allow the ash to separate. There is thus an argument in favour of the subsistence of a chemical union between the inorganic and organic matter of which the substance of farinaceous grain is composed. Should this view be well founded, the amount of ash in grain, it might be expected, would bear a constant ratio to the dry organic matter by weight, in whatever soil it might be grown. It would also follow that cold water will not take up saline matter from an entire seed simply by washing or slight digestion.

The loss sustained by barley in malting may be stated as follows:—

Water.....	6·00
Saline matter...	0·41
Organic matter.	12·52
	19·00

The nature of the saline matter removed from the barley is exhibited in the analysis of steep-water ash, although it is not so easy to explain the source of some of the constituents. The silica has been removed from the barley. That this substance is united with potash is obvious, from the gelantinisation which occurs when hydrochloric acid is added to the steep salt. The origin of the carbonic acid, or rather its condition of union, is not so apparent; it might be attributed to the impurity of the water, but the presence of a minute amount only of lime opposes this explanation. The water used in the steep was the Clyde water, which contains chalk in solution and sulphate of lime. To this source the sulphuric acid may owe its presence. The richness of steep water in alkaline salts suggests its employment as a manure. A considerable part of the organic matter of the barley is dissipated in the form of carbonic acid, but a large portion of the albumen and sugar is also dissolved in the water, the solution of the albuminous matter being probably assisted by the action of the phosphates which are capable of dissolving, it is well known, some of its forms, more particularly casein. The quantity of

nitrogen obtained from the steep salt, when evaporated and dried at 212°, was very considerable, being equivalent to five and a half per cent. of albumen, if the whole of the nitrogenous matter existed in the form of that principle. But, besides this substance, there was present, also, a large quantity of other organic matter in the steep solution, since the steep salt, when dried at 212°, and then ignited, lost upwards of forty per cent. of its weight.

The views which have been brought forward of the difference in the chemical composition of barley and malt are sufficient to render it obvious that malt is a much more expensive substance, irrespective of duty, than barley for feeding, inasmuch as it is in reality barley deprived of a certain portion of its nutritive matter and salts. The only advantage which it seems to hold out in cattle feeding, is the relish which it gives to a mash; but as this depends entirely upon the sugar which it contains, and which has been produced from the starch of the barley, it is obvious that the same flavour may be imparted by the addition of an equivalent amount of molasses or sugar, should it be considered expedient.

But Dr. R. D. Thomson says he has always found steeped barley to be highly relished by cattle. Malt, however, from the diastase it contains, has the power of speedily converting the starch of barley into sugar; a a handful of malt would be sufficient to saccharise several pounds of barley in the steep. The quantity required in this case would be so small as to obviate any necessity for a change in the duty.

The next set of experiments were made to ascertain the effect of molasses, linseed, and beans in the production of milk and butter. In the seventh experiment, the cattle were fed on crushed barley, steeped in hot water, and molasses; in the eighth, on barley and linseed, and in the ninth on bean-meal. The results were:—

I. Milk.	Dry milk.
100 lbs. of hay, barley, and molasses produce	lbs. 8·06
100 lbs ,, linseed	8·45
100 lbs. ,, bean-meal.	8·13
II. Butter.	**Butter.**
100 lbs. of hay, barley, and molasses produce	2·19
100 lbs. ,, linseed	2.15
100 lbs. ,, bean-meal.	2·25

or, considering the hay a constant quantity, then we have the result as follows:—

I. Milk.	lbs.
100 lbs. barley and molasses produce of milk	23·70
100 lbs. barley and linseed	25·70
100 lbs. bean-meal	25·23
II. Butter.	
100 lbs. barley and molasses produce of butter	6·45
100 lbs. barley and linseed	6·57
100 lbs. bean-meal	7·00

With respect to the comparative effect of linseed and beans, during equal periods in producing milk and butter:—in the case of the white cow, particularly, the results are quite unequivocal; for while during five days the milk produced by beans was equal to the mean of that produced by linseed during ten days, the amount of butter under the bean diet was greater than under any other food whatever. This is an important fact in reference to the source of butter in the food, since the linseed meal, employed in the experiments, contained twice as much oil as the bean-meal. In the brown cow, also, the quantity of butter was greater, especially during the second five days, with beans than with linseed. Molasses produced in the brown cow also a larger quantity of butter than the linseed, while the amount was slightly inferior to that produced by the beans. These facts, then, are not agreeable to the opinion that the amount of butter afforded by a cow is a test of the amount of oil contained in the food, and hence we are not entitled to recommend oily food as preferable, for the production of butter and of fat in animals, to food which experience teaches us to be productive of this effect, although less rich in oleaginous matter. Indeed, the constant practice of giving oil cake to cattle is not an argument in favour of the importance of oil in the formation of fat, since from oil cake as much of the natural oil of the rape-seed or linseed has been removed by expression as mechanical means can effect. The oil cake argument, therefore, *a fortiori*, is calculated to refute the objects to which it is generally applied.

The chemical composition of the linseed and bean-meal is calculated to throw some light on the causes of the differences in the amount of products in the experiments. The following table represents the ultimate composition of linseed and bean-meal, determined by combustion with chromate of lead:—

Table of ultimate composition of linseed and beans.

	Linseed.		Beans.	
		Dried at 212°		Dried at 212°
Carbon	42·51	49·35	40·76	45·59
Hydrogen	6·22	7·26		
Nitrogen	3·78	4·41	4·13	4·61
Oxygen	26·35	30·68		
Ash	6·94	8·10	3·22	3·96
Water	14·20		10·60	

Table of the composition of the ash of linseed and bean-meal.

	Linseed.	Bean-meal.
Silica	34·85	13·12
Phosphoric acid	25·22	35·26
Sulphuric acid	2·85	1·29
Chlorine	trace.	1·75
Lime	6·95	5·18
Perox. iron	3·23	1·80
Magnesia	8·04	9·03
Potash	16·85	23·15
Soda	2·22	9·42

From this and the preceding table, we find that a given weight of beans contains a much larger quantity of phosphoric acid than the same amount of linseed, and hence that the bean-meal ought to be most productive of milk. If the view already noticed be conceded, the proportion of phosphoric acid is in direct relation to the amount of albuminous matter in animal fluid.

The present tables also seem to prove, most conclusively, that the butter of cows cannot possibly be produced from the wax and oil of the food, since the greater portion of the wax of the food reappears in the dung—being expelled from the animal without change, while the butter and wax of the dung greatly exceeds all the oil and wax of the food. From these circumstances it is very much to be doubted whether the wax of hay occupies any place in the production of the fat and butter of animals. In all the experiments the wax of the dung was found always to vary slightly, so that it seems highly probable if the whole of the wax had been extracted from the dung, it would be found that all the wax of the food was excreted by the animals.

The report terminates with the following summary, including some practical conclusions:—

I.—QUANTITY OF MILK PRODUCED BY DIFFERENT KINDS OF FOOD.

In making inquiries respecting the amount of milk afforded by cows, we cannot fail to be struck with the vague and imperfect manner in which the attention of agriculturists is directed to weighing and measuring; thus, for example, in Scotland, where milk is generally reckoned by the Scottish pint, when this measure is compared with the English system there is almost uniformly an error made in over-estimating its capacity. The usual allowance is four English to one Scottish pint, but the true relation between these measures is much inferior to this—the English or imperial pint having a capacity of 34·659 cubic inches, and the Scottish pint of 193·4 cubic inches, a Scottish pint is very nearly equal to three English pints. When measurements have been made according to the Scottish system a certain degree of caution must, therefore, be exercised in converting them to the English standard. Now, as in Scotland the actual measurements are generally made with the Scottish pints, when the amount of milk is stated in English pints, we may almost safely conclude that the estimate has been greatly overdrawn; but, even taking these sources of error into consideration, it is very remarkable how great a difference exists in the amount of milk given by cows under similar circumstances. No one will be surprised at the Alderney cows of Mrs. Tabitha Bramble affording a daily supply of 4 gallons of milk, or 32 pints, when we read in more ancient times of a short-horn giving 17 Scottish pints (51 imperial pints), or 64½ lbs., at 10½ lbs. to a gallon; and of a Roan cow yielding 30 Scottish pints (90 imperial pints), or 115½ lbs., and requiring to be milked five times a day, so that at each milking 2¼ gallons must have been extracted from the animal, an average allowance for one cow during the whole day. All these statements must be understood as referring to cows which are allowed to graze at least during the day, and must be viewed as extraordinary cases. A nearer approach to an average will be obtained by directing attention to the produce of an Ayrshire cow fed in Berwickshire, which yielded, during July, 1845, 6¼ Scottish pints (19½ imperial pints), 25½ lbs., or to an Alderney cow in Lancashire, which supplied an average amount, in June, 1845, of 20 imperial pints—25½ lbs.; but even in such instances, which are taken from lowland pasture grounds, the quantity often exceeds this by several pints, and sometimes also falls below it to the same extent, without any very apparent cause. In Moorland pastures the average amount of milk is, however, much inferior to what has been stated. In one locality in the neighbourhood of Glasgow, where many cows are kept, the supply from each animal does not average more than from 12 (15½ lbs.) to 14 (18 lbs.) imperial pints per day, and in another Moorland farm the amount varies from 10 (12½ lbs.) to 15 (19 lbs.) imperial pints. With a statement of these data for comparison we are enabled to form an idea of the influence exercised in the experiments detailed. When 20 cows were at pasture in Ayrshire they yielded in imperial pints each per day (25½ lbs.); then they were in full exercise, and without any restriction in the amount of their food. They might in these circumstances be represented as in a state of nature, and without any of the artificial conditions which must

always, to a certain extent, interfere with the animal processes. An animal enjoying exercise must also consume a larger amount of food than one shut up, or, in other words, it must convey into the system a greater quantity of material for producing milk than an animal in a state of confinement.

1. *Effect of Grass on Milk.*—For seven days after coming to Glasgow, where they were confined in a roomy and airy cow-house and fed on cut grass, the red cow (the less symmetrical of the two animals) gave a larger amount of milk than when at pasture; the greatest quantity of milk during the week being 27½ lbs., and the smallest amount being 24¾ lbs., the mean being 26½ lbs.: there was, therefore, in this case a decided increase in the amount of milk. With the other cow the result was quite different; the quantity of milk appears to have diminished immediately with the confinement—the mean of the first seven days being 22¾ lbs. It is difficult to account for the great difference in the result of the produce of the two animals upon any other supposition than that the constitution of the one admitted of confinement with less detriment to its system than the other. The causes which have been previously alluded to, when treating of the characters of the animals, may, probably, also supply a solution to these apparent anomalies. But we deduce the important inference from these facts, that no correct generalisation can be arrived at from an isolated example. During the seven remaining days of the experiment the quantity of milk fell off with both cows; that of the brown cow subsiding from a mean of 26½ lbs. to 22½ lbs., and that of the white cow from 22¾ lbs. to 20½ lbs. There was, altogether, a difference in the daily amount of milk from the beginning to the end of the fortnight—in the case of the brown cow of 4 lbs., and in the white cow of two pounds, although the amount of food continued the same throughout.

2. *Effect of Variety of Food on Milk.*—The considerable falling off depended undoubtedly in some measures upon the confinement to which the animals were subjected, although, on examining the tables, it will be found to be a pretty uniform result, that a change of food produces an increase in the quantity of milk, and that after the same diet has been continued for some days the milk begins to diminish in amount. There are several exceptions in the tables, some of which, however, admit of simple explanation. In the second experiment, which was made with entire barley steeped, the quantity of milk decreased very rapidly. In the case of the brown cow there was a difference between the milk of the first and last day of the experiment of 5 lbs., and in the white cow of 2¼ lbs. This arose from a quantity of the barley being ejected by the animals without being digested. Entire malt being given raised the amount of milk immediately, and the quantity continued to rise daily till it amounted at the end of the trial, in the case of the brown cow to an increment of the last over the first day's milk of 3 lbs., and in the white cow of 4 lbs. We can see at once why there was an improvement under the malt regimen, from the circumstance that, being much more soluble than the barley, it was not ejected by the animals; indeed none of it was observable in the dung, while a large proportion of barley was always carried to the dung-heap. The second and third experiments do not serve to prove any point in reference to the dietary of animals, but they may be useful as evidence to show that the more soluble the food is the greater is the amount of milk produced. In the fourth experiment, with crushed barley, the brown cow's milk decreased 1¼ lbs. in sixteen days, and the white cow's 10 oz., or considerably more than half a pound in the same period. In the fifth experiment, with crushed malt, the brown cow's milk declined 2¼ lbs. in sixteen days, and the white cow's upwards of 2¼ lbs. In the sixth experiment, with a larger quantity of crushed barley, the brown cow's milk continued to increase up to the fourth day, and then began to decline; a similar result attended that of the white cow. In the seventh experiment, with molasses and barley, the brown cow's milk reached its acme, or culminating point, on the second day of the trial, and it then continued to decline till the close of the experiment on the tenth day. With the white cow, the greatest amount of milk was afforded on the fifth day, when it began to decline, and gradually diminish till the termination of the trial. In the eighth experiment, made with barley and linseed, the amount of milk continued to increase for a longer period than usual; the largest quantity given by the brown cow was on the ninth day, and by the white on the eighth and ninth days. With the bean-meal, in the ninth experiment, the milk continued to increase up to the fifth day, when the trial closed. That a change of diet is necessary for animals which are kept in a confined condition is proved in a striking manner by the tables accompanying this report, and the results now obtained amply sustain the idea supported by us some time ago in reference to the dietary of human beings shut up in poorhouses and places of confinement. It was then argued that, "in order to retain

he human constitution in a healthy condition, variety of food should be properly attended to," and different species of diet were suggested, as well calculated to supply a series of dishes to the poor. In the asylum for the houseless, and in the house of refuge at Glasgow, the recommendations were followed out, and, accordingly to the report of the treasurer, the dinner meals being varied two or three times every week, "the change in the dietary routine is much relished by the inmates, and may have had some effect in the greater degree of health which has been evident among them of late." The analogy subsisting between the physical nature of human beings and of many of our domestic animals would lead us to the conclusion upon physiological grounds that their dietary should be conducted upon precisely similar principles. To prove this by exact experiments is a point, it will be admitted, of considerable importance to the agriculturist, although it may have been, as might be expected, surmised by many intelligent observers. Not only, however, is variety of food requisite for an animal in an artificial state, but it is found also to be beneficial to one in a condition more akin to that of nature; for it is upon this principle that we are able to account for the superior influence of old natural pastures, which consist of a variety of grasses and other plants, over those pastures which are formed of only one grass, in the production of fat cattle and good milch cows. To any one who considers with attention the experiments which have been detailed there cannot remain a doubt in the mind that cattle, and especially milch cows, in a state of confinement would be benefited by a very frequent and entire change in their food. It might not be too much to say that a daily modification in the dietary of such animals would be a sound scientific prescription.

3. *Effect of Barley and Malt on Milk.*—In considering the influence of barley and malt on the production of milk, it is obvious that experiments II. and III. offer no data from which conclusions can be drawn, except to point out the useful practical fact that grain should never be given to cows in an entire state, but that it should always be ground or crushed, and then steeped before being presented to them. If we compare experiments IV. and V., we find that in sixteen days 141 lbs. of crushed barley steeped produced in the brown cow 342 lbs. of milk, and in the white 351 lbs. of milk, and that both animals gained in weight; while again 168 lbs. of malt produced in the brown cow 310 lbs. of milk, and in the white 345 lbs. of milk, during sixteen days; the former cow gaining some weight, and the latter losing a little. The quantity of malt exceeded that of the barley by 27 lbs., and yet the brown cow gave 32 lbs. less milk with malt than with barley, and the white cow only 6 lbs. less milk; hence in the brown cow 100 lbs. of barley produced as much effect as 131 lbs. of malt, and in the white cow 100 lbs. of barley were equivalent to 119 lbs. of malt. Now, as 100 parts of barley, when malted, become eighty of malt, it is obvious that 100 of barley are equal in value to 125 of malt, for 10 : 100 :: 100 : 125. If we take the mean of the result of the preceding experiment, we find that 100 of barley goes as far in producing milk as 125 of malt, 119 + 131 + 2 = 125. Again, by a mean of three experiments the amount of nitrogen in malt was found to be 1·25 per cent. 52, and that of barley 1·96 per cent. by four experiments, which would make 100 parts of barley equivalent to 128 of malt in nutritive power. These are all remarkable coincidences of theory and practice, and cannot fail to convince us that the proportions stated are very close approximations to the nutritive equivalents of barley and malt; or, in other words, that malt is about one-fifth inferior to barley in its nutritive effects. In considering the sixth experiment, which was made for the purpose of comparing the effect of a large quantity of barley with a large amount of malt, it will be observed, that the experiment commenced when the amount of milk was declining under the malt regimen, but that as soon as the barley was given, the milk began to increase in both cows. The weather, however, at this time became much warmer than it had hitherto been, The mean temperature, as exhibited in the table, became more elevated; but the numbers in the table will scarcely give an idea of the stagnant sultry nature of the atmosphere in the cowhouse, in the immediate neighbourhood of which, in a room without a fire, the thermometer during the five days stood at 66°, and at one period of the thirtieth, or first day of the experiment, rose to 70°. The cattle were during this period very much troubled with flies, which produced, as all agriculturists will understand, much agitation and constant movement. These circumstances are calculated to explain the loss of weight sustained by the brown cow, and it accounts for the fact that the increase of milk was not so rapid as in the previous barley experiment. This experiment may be viewed as an interesting example of the influence which atmospherical causes exercise upon the production of milk, and exhibits a result perfectly in accordance with the experience of good agricultural observers. From

the circumstances mentioned, it is obvious that this experiment should not be taken apart from the previous barley trial, since the conditions were somewhat different under which it was made; but we have employed it along with the other trial in striking an average, as in miscellaneous table No. 3, and in calculating the deductions from experiments IV., V., and VI.

4. *Effect of Molasses, Linseed, and Beans in the Production of Milk.*—If we examine the miscellaneous table No. 3, we find the mean quantity of milk afforded by the brown cow, every five days under different regimens, was as follows:—barley, 107 lbs.; malt, 97; barley and molasses, 101; barley and linseed, 102½; beans, 99¾. And by the white cow the mean quantities respectively were, every five days, barley, 109 lbs; malt, 108½; barley and molasses, 112¾; barley and linseed, 115½; beans, 115·6-10ths. Of all these articles of food, in both cases, malt gives the smallest produce. Then comes, with the white cow, barley, and the other articles increase in effect as they stand above, bean-meal affording the greatest amount and produce. It will be observed in examining the bean-meal table, that the milk increased up to the termination of the experiment; and that in the case of the white cow, the quantity yielded exceeded that supplied by this animal on any previous occasion, except in one solitary instance under the grass diet. The quantity of milk given by the white cow on the 18th September under the bean regimen, amounted to 25½ lbs., thus approaching closely to that afforded by both cows when they were at pasture three months previously. This cannot fail to be admitted as an interesting fact, and is corroborative of the propriety of the partiality of cow-feeders for bean-meal as an article of nutrition for their stall-fed cattle. If we take a mean of the produce of the two cows, as previously stated, we shall find the relative influence of each in the production of milk to be as follows:—commencing with that which possesses the lowest nutritive power, malt produces 102·66 lbs. of milk; barley and molasses 106¾ lbs; bean-meal, 107·68; barley, 108; barley and linseed, 109. We think it better to state the mean produce of the two cows, because it will afford an average of what we might expect to meet with in feeding a number of cattle with these various articles of food. A comparison of the experiments on the two cows, however, fully demonstrates that one kind of food will produce a greater influence on one animal than on another; and that, as with human beings, probably attention should be bestowed on what is agreeable to each individual animal, both in reference to its palate and constitution. For it should be always borne in mind that stall-fed animals are not in a natural condition, and that being placed under artificial restrictions a due consideration of the adequate means of counterbalancing the adverse circumstances of their condition can alone conduce to a true theory of humane stall-feeding.

5. *Influence of quantity of Grain in the production of Milk.*—To ascertain the amount of grain best calculated to afford the largest supply of milk is a practical point of no small importance to the cow-feeder. Perhaps from miscellaneous table No. 3. the best solution to this question may be obtained, in reference to the articles of food employed in the present series of experiments. In the barley experiment it will be observed, that when 12 lbs. of barley were given daily the amount of milk was inferior, in both cows, to that obtained when 9 lbs. was the diurnal allowance. This result seems so decided, in both series of experiments, that it may almost be considered as established, that no adequate advantage appears to be attained by pushing the supply of barley to a cow beyond the extent of 9 lbs. daily. An increase in the quantity of malt appears sometimes to increase the quantity of milk; but in general, the same deduction may be made with reference to malt as to barley, that in a remunerative point of view, 9 lbs. a-day may be considered a large proportion of malt to supply to a cow. It is highly probable, indeed, that a smaller amount, especially if the animals were allowed a certain limited degree of exercise, would be found fully as efficient as a larger quantity. We have, in the body of the report, endeavoured to explain this upon the physiological principles of digestion, and to show that, as ruminating animals, more especially, are possessed of great capacity of stomach, an excess of concentrated food, by failing to effect adequately the purpose which bulky food accomplishes,—of exciting the coats of the stomach to secrete their digesting fluid,—will tend rather to diminish than to increase the result of that which we desire to gain.

6. *Rate at which Food is changed into Milk.*—As a variety of views prevail with regard to the period required by the animal system for the conversion of food into milk, perhaps the first series of these tables will assist us in forming more precise notions upon this curious physiological question. An inspection of these tables shows us that the largest amount of milk is supplied, by stall-fed cows, in the morning, now as comparatively a small amount of food is consumed during the night, is is obvious that this superior amount of milk must be derived

from the previous day's fodder. An observation which was frequently made, viz., that undigested food did not appear in the dung till sixteen hours after being swallowed, would tend to demonstate that, during this period at least, absorption of the nutritive part of the food was going on; since we know that along the whole course of the intestinal canal the soluble food continues to be taken up through the coats of the viscera.

II.—RELATIVE INFLUENCE OF DIFFERENT KINDS OF FOOD IN THE PRODUCTION OF BUTTER.

In the miscellaneous table No. 3, we have collected the amount of butter produced by five kinds of food during periods of five days each. But previously to these trials, thus arranged, the largest quantity given by the brown cow was under the grass regimen. The first five days of the experiment yielded 4·93 lbs. of butter, after which the quantity diminished to the last five days of the trial, when the quantity yielded amounted to 3·75 lbs., a proportion not superior to what was produced in some of the subsequent experiments. The same law does not appear to hold with reference to the diminution of the butter as pertains to that of the milk, when the food has been continued for some time. We frequently find, on the contrary, the amount increasing towards the close of the experiment, even when it was continued for ten or fifteen days. The largest amount of butter was afforded by the brown cow by crushed barley. During the third series of five days the amount was 3·935 lbs., bean-meal gave the next greatest quantity, 3·69 lbs. in five days; then comes barley and linseed, 3·689 lbs. during the first five days, barley and molasses 3·63 lbs, and malt 3·60 lbs. In the case of the white cow the quantity was, beans, 3·76; barley and linseed, 3·421; crushed barley, 3·376; barley and molasses, 3·26; and malt, 3·126. With both animals we observe that malt is lowest in the scale, a fact which seems in some measure to militate against the idea of the origin of the butter being in the sugar of the food. Be this as it may, however, although there are many counter arguments in favour of the opinion that sugar affords such a supply, we think the tables Nos. 1 and 2 (miscellaneous) tend to show that there is no relation between the butter of the milk and the wax and oil of the food, since frequently, when the oleaginous matter of the food is small, the butter is more considerable than on other occasions when the reverse happens. Since then the facts contained in the tables, and the arguments used in the body of the report, seem to prove that the butter cannot be supplied from the oil of the food, it becomes an interesting point of the agriculturist to learn from what element of the food it proceeds. It may safely be inferred that it must be formed from some other constituent of the diet by means of the vascular system, either in a primary or secondary stage. Sugar affords the most simple element from which it may be produced, because we now understand how the acid of butter can originate from sugar; but even the albuminous principles might afford butter. Upon these grounds, then, we can infer that a certain degree of exercise would tend more to the production of fat than if the animal were allowed to remain at rest: because, as the source of the fat or butter is dependent on the process of respiration, it is obvious that the more the function is encouraged within moderate bounds, the greater the amount of oil-giving principle of the food will be taken into the system and converted into fat. We believe this theoretical deduction is perfectly in consonance with the experience of good observers, who find that box or hammel feeding is more conducive to the health of cattle and cows destined for the butcher, or for the production of butter, than close plant-like confinement, which is foreign to the nature of every animal, and at variance with the first principles of physiological science.

The third report by Dr. T. Thomson has reference to the relative value of barley and malt in fattening bullocks:—

Two lean bullocks, about three years of age, were fed, one on barley, and the other on malt, given in addition to about fifteen pounds of hay. The barley and malt were given in equal quantities, first six pounds, then nine, and lastly twelve pounds. The grain was at first given entire, but it was found not to be capable of digestion, and consequently it was afterwards ground into meal, and made into a mash with hot water. The experiment was carried on for a fortnight, at the and of which time, the bullock fed on barley had increased in weight one hundred and nine pounds, and the other fed on malt only ninety and a half pounds, showing a decided superiority of barley over malt when employed weight for weight, for fattening bullocks. At this time the bullocks were seized with some epizootic fever and diseased feet, on recovering from which comparative experiments were again commenced with hay, barley, and turnips for one bullock, and hay, malt, and turnips for the other, the result still being in favour of the barley. The turnips being diseased, linseed oil cake was substituted for them, and with the same result. Throughout these experiments, the barley proved better than malt for fattening cattle.

IMPROVEMENTS IN THE MANUFACTURE OF BREAD.*

BY HENRY M. MEADE.

THE first part of this invention relates to the manufacture of bread from the flour (or meal, as it is frequently called) of Indian corn and wheaten or rye flour.

In place of mixing the Indian corn flour with the wheaten or rye flour, and then making the bread in the ordinary manner, the patentee proceeds as follows:—The Indian corn flour is first scalded with boiling water, and spread out to cool. A sponge is prepared from wheaten or rye flour with brewers' or bakers' yeast (brewers' yeast requiring to be mixed with double the quantity of water that would be used with bakers' yeast), by making a batter of part of the wheaten or rye flour with the yeast and water, and then adding further quantities of flour to make it thick enough to rise. When the sponge is light, it is well beaten, and the scalded and cooled Indian corn flour mixed with it; the remainder of the wheaten or rye flour is then added, and the whole is covered up and allowed to rise until perfectly light; after which, it is divided into loaves, and baked in tins. The proportions in which the materials are used are, from one-third to one-half, by weight, of Indian corn flour, and from two-thirds to one-half of wheaten or rye flour; but these quantities may be varied, if desired.

In the above process no ferment is used; but the patentee prefers to employ a potato ferment, or a ferment prepared from Indian corn flour. The potato ferment is made in the usual way, and after being strained through a colander, is added to the sponge, and then the scalded Indian corn flour and the remainder of the wheaten or rye flour is mixed, as before described; about 20 lbs., or more, of potatoes are used in making the ferment for a batch of 10 bushels. The bread thus made, by combining Indian corn flour and wheaten or rye flour, is called "union bread."

A ferment (the preparation of which constitutes the second part of this invention) is made from Indian corn flour in the following manner, supposing the batch to be about 10 bushels:—Malt and hop liquor is first made, the same as for a potato ferment, and one gallon and a half of it, in a cold state, is mixed with water at a temperature of from 80° to 100° F.; into this liquor 5¼ lbs. of Indian corn flour, 2¼ lbs. of rye flour, and rather more than 1 lb. of bean flour are stirred (the patentee prefers that these matters should be well mixed and sifted together previous to so using them); and, after they have been stirred for ten minutes, 2 lbs. of wheaten flour are stirred in. The tub being in a warm situation is then covered with a sack or cloth, and allowed to stand until the fermentation is completed, which will take about eight hours, when it will sink; the ferment is then ready for mixing into a sponge in the same manner as a potato ferment: it is not only applicable to the manufacture of the "union bread," but also for making wheaten or other bread.

The patentee does not claim the use of Indian corn generally, nor does he confine himself to the above details. He claims, Firstly—the mode, above described, of making bread from Indian corn and wheat or rye, by first producing a sponge with wheaten or rye flour, and combining the meal or flour of Indian corn therewith; and also the combining the use of a potato ferment with Indian corn and wheaten or rye flour for making bread. Secondly—the applying a ferment of Indian corn in the manufacture of bread.

* *Newton's London Journal.*

REPORT ON THE COMPOSITION AND AGRICULTURAL VALUE OF KELP, READ AT A MEETING OF THE CHEMICO-AGRICULTURAL SOCIETY OF ULSTER.

BY JOHN F. HODGES, M.D.

THE subject of special manures at present engages so much attention, and promises, as our knowledge of the composition of the soil and its productions extends, to become of such great importance to agriculture, that my attention has naturally been frequently directed to its consideration, especially in connection with the peculiar circumstances of this country. Though in England, and still more in Scotland, extensive experiments have, within the last two or three years, been instituted, for the purpose of testing the value of the various fertilisers offered to the notice of the farmer, in Ireland comparatively few properly conducted trials have, as yet, been made with any artificial manure. It is, indeed, but natural that our cautious Northern farmers should regard with suspicion the extravagant pretensions of some advertised manures, and should hesitate to abandon their old-tried, though sadly mismanaged auxiliary, farmyard manure, for expensive preparations, of the composition of which they are profoundly ignorant. A time has, however, arrived when our farmers must make themselves

acquainted with the various applications proposed by science for supplying their exhausted fields, in the most economical manner, with the materials required for the development of their crops.

Among the numerous advantages which the farmer has derived from the application of chemical science to the advancement of his profession—the information which it has given to him, that the different families of plants, cultivated as food for man and the inferior animals, are not more distinguished by their external appearances than by a difference in the amount of certain inorganic matters which they select from the soil for their support, is of the highest practical importance. When the chemist, by repeated examinations of the ashes of plants, proves to the farmer that the corn plants, which are cultivated for the sake of their seeds, extract from the soil a large amount of soluble compounds of silica, and also compounds of the curious waxy-looking substance phosphorus, while the clover and the bean take up chiefly compounds of lime and magnesia; and that his potatoes and turnips, to come to perfection, require that the soil in which he places them should be well supplied with the alkalies, potash and soda, which are found predominating in the ash which is left when these root crops are burned—a new light is thrown upon all his operations; he at once perceives that the corn, the clover, and the potato crop, must affect the soil in a very different manner, and that a field must require a different treatment to maintain it, in productive condition, according to the kind of crop produced and developed at the expense of the store of materials provided within it by Nature, or placed there by the care and diligence of the husbandman. This knowledge delivers him from the utter helplessness of ignorance, and stimulates him to make experiments for the purpose of discovering the best means of supplying his crops with the materials required for their development. To assist our farmers in conducting such experiments, I considered that it would be useful to investigate how far, in substances with which they are already familiar, and which lie at their own doors, they possess a supply of the ingredients which science points out as adapted to restore to their fields the inorganic materials year after year converted into flesh or grain and carried away to market. At some future time I propose directing your attention to the composition and economy of guano, and the various fertilisers introduced into this country to supply our fields with the mineral matters, for which we so thoughtlessly construct expensive sewers to carry them into the sea. Analysis of the water of the ocean shows us, that in it are contained all the inorganic ingredients which our crops take away from the soil—that it is, in fact, a liquid soil, from which myriads of vegetables receive the materials for their perfect development. Along our coasts, the plants nourished by the mineral and saline matters dissolved in the waters of the sea have long been employed by the farmer as applications to the soil, and in many parts of the kingdom are regarded as his sheet-anchor; thus, in some small degree, restoring to our fields the substances lost by the faulty arrangements of our farm-yards and cities. My attention was lately drawn to the sea-weeds of our coasts, from being engaged in the analysis of the well-known substance KELP, produced by their incineration, and which is now exciting considerable interest, as a source of the valuable metallic-looking substance iodine, at present so extensively employed in medicine. So far as I am aware, no complete analysis of our Irish kelp has yet been laid before the public. It will, therefore, be of interest that the composition of this valuable and accessible source of the materials required to render our fields productive should be made known.

The mode of preparing kelp, as generally practised on our coasts, is so well known, that I need not allude to it further than to state, that the sample submitted to me for analysis, was prepared on the shores of the Lough of Strangford, where, I understand, by the use of iron bottoms for the kilns, and by the careful management of the weed, an article of superior quality is produced. It may also be observed, that when the object of the kelp burner is to prepare a kelp rich in iodine, only some particular species of the fucus family should be employed; but when it is required merely for agricultural purposes, all the numerous species, both of drift and shore weed, may be used with advantage.

The sea-weeds, as cast on our shores, or cut from the rocks, contain a very large amount of water—thus, the fresh leaves *(Frond)* of the bladdered wrack *Fucus vesiculosus*, and of the tangle *(Laminaria digitata)*, which are found in such great abundance on our coasts, when dried at 212°, and incinerated, yielded—

	Water.	Organ. mat.	Ash.
Bladdered wreck	68·8	26·2	5·0
Tangle	81·1	13·1	5·8

Of the stalks of the tangle, which are considered so valuable by the kelp-burners on the North-East coast, two samples gave as follows:—

	I.	II.
Water	84·00	83·10
Organic combustible matter	10·40	11·06
Incombustible matter, or ash	5·60	5·84
	100·00	100·00

Mean of ash afforded by leaves and stalks together 5·5 per cent., or a ton of the weed, as taken from the sea, would yield about 123 lbs. of incombustible mineral matter or kelp. The inquiry now presents itself, how far the ash is capable of supplying our fields with the mineral and saline matters removed by cultivation.

As kelp is a substance remarkably complex in its composition, and contains a number of ingredients with which our farmers are not familiar, and the enumeration of which would only serve to perplex them, I consider that it will be sufficient to state the proportions of those ingredients which possess an agricultural value. From the great variety of weeds employed in its manufacture, the composition of kelp must be expected to vary considerably. The specimen from which I obtained the following results was received from a member of our Society, A. H. Montgomery, Esq., of Tyrella, County Down, and was prepared on the shore of Strangford Lough, near Greyabbey:—

100lbs. of this kelp contained—	per ton.
Potash	8·22, or 184½ lbs.
Soda	25·82, or 578¼ lbs.
Lime	5·17
Magnesia	8·47
Sulphuric acid (vitriol)	20·17
Phosphoric acid	5·43
Chlorine, one of the ingredients of common salt	11·70
Silicic acid	2·71

The analysis just given shows, that in kelp we have a rich supply of the inorganic ingredients required by our crops, while the large amount of salts of potash and soda which enters into its composition, point it out as peculiarly adapted for the nourishment of our potato and turnip crops. The sample examined, from containing but a small amount of soluble silica, would not be so well adapted for the growth of the corn crops, except in situations where a sufficient supply of soluble silicates were already present in the soil; but, in general, the kelp of our coasts contains a much greater amount of silicates, from the common practice of fusing a quantity of sand with the melted ash—a practice which, for the sake of increasing the weight, is carried to a shameful extent by some kelp-burners. As kelp affords us, as I have shown, a convenient source of the most important elements of plants, and in a convenient portable form, so that we can readily carry it into the interior of the country, and apply it in all situations where its action would be still more beneficial than in the neighbourhood of the sea, it is, I conceive, of importance that some experiments should be instituted with this substance, by such of our members as possess the opportunity. From several experiments with different samples of kelp, I find that a hundred weight of that manufactured on our coasts usually contains from 60 to 70 lbs of salts soluble in water, which would afford the plant from its first formation a ready prepared supply of nutritious materials, while the alkaline silicates and salts of lime, magnesia, &c., would continue to exercise a beneficial influence upon the fertility of the field, even beyond the present season.

The average produce of potatoes in many districts in the North of Ireland, I have ascertained by careful inquiry, does not exceed 350 bushels,* or 19,600 lbs., per Irish acre, an amount of tubers which analysis shows us to contain about 190 lbs. of matter extracted from the soil. The chief constituent of the potato tuber is potash, an expensive article with the manure dealer, 92 lbs. of which is taken away from our fields with every 350 bushels of potatoes that we send to market. Now, half a ton of kelp of the same character as the sample examined, contains, as we have seen, about 92¼ lbs. of that alkali; so, by applying that quantity of it to a portion of ground in which we have produced 350 bushels of potatoes, we shall not only maintain its fertility, so far as it depends upon the presence of that substance in the soil, but, also, give it a supply of other matters which will be useful to the succeeding crops of the rotation; for the amount of soda given to the soil in half-a-ton of kelp, is much greater than is required for the development of the potato crop, 350 bushels of potatoes requiring only 54½ lbs. of soda, while the kelp contains 289 lbs.

The economy of using kelp for supplying the tuberous plants with the fixed alkalies

* I am aware that this return is considerably under the produce of many districts with which I am acquainted; in Ards, and in other situations along the coasts of Down and Antrim, it is not unusual to obtain double the amount mentioned above. But that 350 bushels per Irish acre should, at present, be regarded as a fair produce in several parts of the country, is a proof that either an injudicious system of cropping has been followed, or that the capabilities of the soil have not been fully developed.

will be rendered more evident, when we find upon calculation that to give the soil the amount of the substances, 146½ lbs., required by the potato crop, an application of more than 1½ ton of the best Peruvian guano would be necessary; therefore, kelp appears, from its composition, to be pre-eminently adapted as a manure for potatoes, and as supplying the soil in an economical manner with a considerable amount of sulphuric acid, lime, and magnesia; its effects upon the production of the clover crop, also, would be most beneficial. What we require particularly at present is, accurate experiments on this and other subjects, as yet but imperfectly investigated. We want trials made, in this country, on soils of known composition, with substances like kelp, accessible to a large body of our farmers; and, it appears to me, that such experiments should be at once commenced. We cannot on the farm, as in the laboratory, within a few months test the value of new plans or processes; at least twelve months, sometimes several years must elapse, before the experiments of the farmer can be brought to a conclusion; for frequently the effects of an application to the soil is experienced through all the crops of a rotation. We must labour diligently to increase, by every possible means, the as yet limited stock of facts which we possess. We require such facts to direct us in our investigations—to afford us a foundation for reasoning on the numerous obscure points of agricultural practice. In addition to the public benefit derived from such investigations properly conducted, they are of great value by the interest which they excite, and the habit of observing nature which they produce in the experimenters themselves; I would, therefore, respectfully suggest to the Council that trials of the effects of kelp upon the potato and turnip crops should, without delay, be made by some of the members of our society.

When sea-weeds are burned for agricultural purposes, the heat, as suggested by Professor Johnston, should be regulated so as merely to burn away the organic matter, without allowing the ashes to fuse into a solid mass, as is customary at present; by keeping the heat moderate the kelp may be obtained in a powder, in which form it is obvious that its application will be more convenient. The chemical reader will also perceive that in the preparation of kelp we might, if desirable, with great convenience increase the amount of silicates, by adding to the melted ash a quantity of fine flinty sand, and increasing the heat as far as possible. I am informed that all the sea-weed at present produced on the coasts of the County Down are required for the use of the farmers whose lands border the sea; but fortunately we possess the means of assisting Nature, so as to increase the production of sea-weed to an almost unlimited extent, by simply placing pieces of rock in the water along the shores. The stones placed in this way are soon found to produce a rich crop of weeds; and I am informed by Mr. J. Andrews, of Comber, that in many districts on the coasts of the County Donegal, the poor farmer would be unable to extract any produce from his fields did he not, year after year, quarry stones from the hills, upon which, when placed in the sea, he procures a crop of sea-weed, the application of which supplies the soil with the potash soda and other matters taken away from it by excessive cropping.

It must not be supposed, from the preceding remarks, that I consider kelp as the only form in which sea-weed should be applied to the soil. Experience has too clearly shown our farmers the utility of applying the weed in its fresh state, to lead us to question that important effects may be produced by the decomposition of the *organic* matters which it contains; but as kelp presents us with those *inorganic* ingredients of our crops, the presence of which in the soil is so essential, in a cheap, portable, and durable form, so that not merely the dwellers on our coast, but the farmers in our midland counties, may be enabled by its use to maintain the production of their fields, its manufacture, I conceive, should receive encouragement.

IMPROVEMENTS IN THE APPARATUS USED IN THE CONCENTRATION OF SULPHURIC ACID.*

BY EDEN THOMAS JONES.

CONSIDERABLE inconvenience has frequently been experienced in the ordinary process of concentrating sulphuric acid in glass vessels, from the frequent breaking of the glass vessels employed in the operation, entailing thereby a loss of the acid (to the great annoyance of the neighbourhood); and from the necessity of maintaining a high degree of temperature in the laboratory, to defend the glass vessels from all drafts or currents of cold air, which prove so destructive to the vessels when they are highly heated, great care is required. To remedy these inconveniences, the patentee employs a vessel which he terms a protector, made of sheet-iron, tin, or other material not liable to be injured by

* *Newton's London Journal.*

the heat of the process; it may be cylindrical, square, or of any other figure, provided it completely envelopes the glass vessel or retort when at work; and it should be four or five inches larger in diameter and height than the glass retort, so as to enclose the latter in an atmosphere of hot air during the operation. The advantages to be derived from the application of this invention are as follow:—The process will be shortened, a considerable saving in fuel and labour will result, and the glass vessels will last longer.

The patentee claims the protecting of vessels of glass or glass retorts used in the concentration of sulphuric acid, for the purpose of defending them from the injurious effects of cold air, as described.

GALVANO-PLASTIC WORKS AT BERLIN.

The Galvano-plastic process has been applied on a large scale at the establishment of the Baron de Hackewitz, at Berlin—a colossal plaster *fac-simile* of Ludovosi's Head of Juno, and a bust in plaster modelled for the head by the sculptor Rauch, having been both covered with bronze. The frontal region of the head of the statue is upwards of six feet in diameter, and nearly eighteen in circumferenee. The operation was performed in the presence of the King—and so successfully that no after application of the chisel was necessary. The King gave orders for preparing, for the same process, a plaster cast of Thorwaldsen's statue of Christ, and a model in wood of the gates destined for the church of the royal palace of Wittemberg—which are to bear in relief the texts of the ninety-five theses of Luther. The colour of the Baron de Hackewitz's bronze, presents, when applied, shades of great beauty and variety, and it resists the influences of the weather.

IMPROVEMENTS IN THE PREPARATION OF MATERIALS TO BE EMPLOYED FOR PRODUCING ILLUMINATION.*

BY HENRY CLARK.

These improvements in the preparation of materials to be employed for producing illumination consist in a novel mode or process by which an essential oil, produced from the distillation of resin, may be purified and rendered a fit substitute for oil, capable of being burned in lamps and employed in other situations.

* *Newton's London Journal.*

The most economical material which can be used is the essential oil obtained by the distillation of the resin of commerce, commonly called resin oil or pine spirit. Any given quantity, say one gallon, of this material, produced in any of the known ways, is placed in an earthen, wooden, metallic, or other suitable vessel, and the purifying matter is introduced thereto. This purifying matter consists of caustic potash, soda, or lime, mixed with water, in the proportion of (say) from eight to sixteen ounces of the caustic material to one pint of water; but these proportions may be varied according to the condition of the essential oil or spirit to be acted upon, that is to say, when the oil or spirit is more foul than usual, or contains a great quantity of colouring matter, then the larger quantity of the caustic material is employed. Into the vessel containing the said gallon of essential oil or spirit, from one to four pints of the caustic solution, either in a cold or warm state, is introduced—the quantity of the solution required depending upon its strength and the condition of the spirit or essential oil, which is a matter that cannot be readily defined, except in a general way. It may, therefore, be stated generally, that the oil of resin, in its usual commercial state, will be properly acted upon by a solution of eight ounces of the caustic material in a quart of water, applied to a gallon of the essential oil.

These materials being introduced into the vessel, as above said, must be agitated continually, for the space of from one to two hours; and when the mixture has been so treated, it may be allowed to settle for about twelve hours; and being then drawn off, and filtered through a layer of cotton-wool and animal charcoal (fresh calcined) it is in a fit or purified condition for burning and for commerce.

When the essential oil is required to be brought to a more purified condition, it is taken from the vessel in which it has been acted upon by the caustic alkali, and submitted to a process of distillation. The patentee prefers to introduce the caustic materials with the essential oil into the still, in order that they may be distilled together, which produces the best result; but he sometimes distils the essential oil, when drawn off from the alkaline solution, without the caustic material, merely introducing into the still a quantity of water, sufficient to prevent the oil from charring; or the same object may be effected by introducing into the still a jet of high-pressure steam. The essential oil, after it has passed through the still, must be subjected to filtration, through cotton-wool and charcoal, as before said.

The patentee states, that he does not confine himself to the use of oil of resin alone, but he applies his process of purification to any description of essential oil, obtained from resinous substances; he therefore claims, firstly, treating resinous essential oils with caustic alkali, in the way described, for the purpose of purifying such oils; and, secondly, a further process of purifying the said oils by means of distillation, as above described.

LIGHT FROM ELECTRICITY.

BY E. A. KING.

THE nature of the invention consists in the application of continuous metallic and carbon conductors, intensely heated by the passage of a current of electricity, to the purposes of illumination. The metal found to be the most advantageous to be used for the purpose, is that which, while it requires a very high temperature for its fusion, has but a feeble affinity for oxygen, and offers a great resistance to the passage of an electrical current. Platinum, though not so infusible as iridium, has but little affinity for oxygen, and offers a great resistance to the passage of the current; and as it is abundant, and easily worked into the form required, it appears to be preferable to any other metal. The platinum should be worked into thin sheets known as leaf platinum. This may be accomplished by the ordinary process of the gold-beater; but a more accurate method is to place a piece of platinum foil between two thick plates of rolled copper, and reduce the whole to a thin sheet by rolling, when, on separating the copper pieces, the platinum leaf will be found of uniform thickness in every part. In this way it may be obtained so thin, that on holding it before a printed page the letters can be distinguished through it. A strip is to be cut from one of these sheets of a width proportionate to the quantity of the current, which, with Grove's cells, having the platinum plates three inches long and two inches wide, is about one-fourth of an inch, and of a length proportionate to the intensity, which of course varies with the number of cells. Great care must be taken to cut the platinum strips of an equal width throughout, and with a clean edge, as, if this be not carefully attended to, the strip will be unequally heated, and will be fused in one part before the other parts have obtained a sufficiently high temperature to produce a brilliant light. The platinum strip is now to be suspended between forceps, in an instrument made for the purpose, consisting of a square brass bar, fixed into a wooden stand, having a binding screw attached to its lower end. Two arms are attached to sockets, which slide on this bar, so as to admit of their being placed at different distances from each other. They are both bent at right angles, and terminated by broad forceps tipped with platinum. These forceps are closed by milled screws; the arm has a rod, with a screw cut on it passing through it, and by means of two nuts working on this rod, the arm may be adjusted to any required height, and the distance between the forceps thus regulated. The rod passes through the stand, and is attached to a binding screw. The socket is lined with ivory, or some non-conducting substance, so as to prevent any metallic communication between the arm and the bar; a strip of platinum leaf is first clamped in the upper forceps; the arm is now adjusted to any required height, and the lower forceps are closed so as to clamp the lower end of the strip of platinum. It may now be included in the battery circuit, by attaching one of the wires to one binding screw, and the other to the second. The current should be one of considerable intensity, and the distance between the forceps should be sufficient to prevent the platinum being fused. The distance may be lessened by raising the arm and shortening the strip of platinum until it attains the highest temperature it will bear without fusing, or, the same object may be attained by increasing the intensity of the current. A glass shade, which serves to screen the platinum from currents of air, dust, &c., may then be placed over the apparatus. When the carbon is used, it becomes necessary, on account of the affinity this substance has for oxygen at a high temperature, to exclude from it air and moisture. To accomplish this in the most perfect manner it should be enclosed in a Torrecellian vacuum. One form of the apparatus for this purpose is a glass tube, similar to those used for barometers, except that it has its upper end enlarged into a cylindrical bulb, and a stout platinum wire sealed in at the top. A binding screw is fixed on the top of the wire, whose lower end screws in an iron piece, to this piece the forceps are attached, and it is connected with a similar piece by a porcelain rod. The forceps are attached, and clamp the lower end of a piece of carbon, which has its upper end held by the others; a copper wire is fixed in the piece, and extends to the bottom of the tube; the tube is filled with mercury, in the same manner as a barometer, the usual precautions being taken to expel the air; its length, independent of the bulb, should be about thirty inches, so that when it is inserted in a cup of mercury, a vacuum will be

formed in the bulb. The instrument is included in the electrical circuit by connecting one of the wires from the magnetic or voltaic battery with a binding screw, fixed on one wire, and the other with a wire which passes into the mercury in the cup at the bottom of the tubes. The circuit is thus completed by the column of mercury, and when it is depressed in the tube by the formation of vapour of mercury, the connection is preserved by the copper wire, and that form of carbon found on the interior of coal-gas retorts which have long been used, is well suited for this purpose, and may be worked into the form of either small pencils or thin plates, by the aid of the saw and file. As carbon will bear a very high temperature without fusion or volatilisation, it may be employed when a very intense light is required. When an intermitting light for the use of light-houses, or for other purposes is required, it may be obtained by breaking the circuit at intervals by clock-work; to effect this, one of the wires from the magnetic or voltaic battery is connected with a spring, which is made to press on the circumference of a metallic wheel, fixed on one of the arbors of the clock having certain portions of its surface cut away, so as to break and close the circuit at any required intervals. When the apparatus is suitably sealed, it may be applied to submarine lighting, and also to the illumination of places where it is necessary to guard against the inflammation of highly combustible or explosive compounds, as in powder-magazines, mines, &c.; when a current is of sufficient intensity, two or more lights may be made in the same circuit, care being taken to regulate the power by increasing or diminishing the number of armatures, if a magneto-electric machine is the source of electricity; or the number of shells, if a voltaic battery be used; so that the united resistance of the strips of platinum, or carbon, shall be sufficient to prevent the passage of such a quantity of electricity as would destroy them.

The claim is for the application of continuous metallic and carbon conductors, intensely heated by the passage of a regulated current of electricity, to the purposes of illumination.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE CAUSES OF DISEASE.*

THIS is the title of a communication, by Dr. Hort, to the *New Orleans Medical and Surgical Journal*, in which the writer seeks to prove that all diseases, except such disturbances in the system as may arise from external injury, or the internal administration of poison, and perhaps, in a few cases, from sudden and great changes of temperature, or any excessive indulgence of the appetite or passions, are produced by organised matter in some form or another. He supports his views by a reference to the fact, that parasitic existences have been discovered, at various times, and by different observers, in the blood, in the secretions, and in the various tissues and textures of the human body; also in and on various animals and plants; and in the majority of instances these parasites have been a source of disease. He also argues that miasmatic poisons require, when applied to the animal system, several days, before the development of any effect—a result dependent on the organised nature of the agent, for ordinary poisons never delay their action so long; but here the poison, like the ova of insects, or the germs of plants, requires time for its development and multiplication. Again, it has been established by Moscati and Boussingault, that organic matter exists in extremely small quantities in the noxious air that hovers over marshes:—

"Moscati, many years ago, suspended in the air, over the rice-grounds of Tuscany, a globular glass filled with ice. An abundant deposition of dew took place upon its surface, which, when collected, appeared at first to be pure limpid water. There was soon, however, an appearance of little flakes, possessed of properties peculiar to animalized matters; and finally, at the end of some days, the liquid putrefied completely."

The most interesting and really practical portion of the preceding paper is that which refers to the

ORGANIC NATURE OF SMALL-POX CONTAGION.

The author quotes the following experiments by Professor Riddell:—

"A perfectly clean ounce-phial was half filled with distilled water; a small glass tube, with a capilliary orifice, was made to

* *Lancet.*

terminate near the bottom, the upper and larger portion of the tube bending horizontally to receive the silver nozzle of a delicate pair of bellows; several turns of gauze were passed around the mouth of the phial, embracing the tube, and the whole was securely fixed in an appropriate frame-work. This apparatus was carried to the city (Cincinnati) pest-house, and under the superintendence of Dr. Herron, it was placed on a table two or three feet from a small-pox patient, just in that stage of the disease when the circumambient air was supposed to be most contagious. The bellows were blown by the nurses pretty constantly for twelve hours, thus presenting a great amount of noxious air to the distilled water. The apparatus was left undisturbed until it came into my possession, three days after, when I made the following experiments.

"1. One-fourth of a drachm of the water contained in the phial, evaporated very slowly in a watch-glass, over an alcohol lamp, left concentric circles of a whitish substance. Upon bringing this residue under the object-glass of a good microscope, it consisted mostly of long crystals, which shot from each other at right angles. The outer margin of each concentric band was less distinctly crystalline, and evidently contained some other substance.

"2. A minute drop of sulphuric acid, carefully distilled and collected on a glass rod, so as not to leave the slightest trace when evaporated from clean glass, was placed upon some of the residue. The application of heat rendered the acid black, and upon complete evaporation a dark stain was left, thus showing the presence of organic matter.

"3. Upon adding a drop of pure sulphuric acid, to near an eighth of a drachm of the water, and expelling the water by a careful heat, the acid became black. This experiment, as well as the one which follows, was performed upon a piece of Florence flask, rinsed in clean water, and then heated to redness over an alcohol lamp, in order to remove every trace of organic matter.

"A drop of the water hastily evaporated left a whitish residue, not crystalline to appearance, but consisting of extremely minute grains. Upon the application of a high heat short of redness, it became dark coloured, indicating the presence of organic matter by the charcoal liberated. A still higher heat, in contact with air, removed the dark colour, and left a mere trace of white adherent powder."

These experiments support the views which the authors advocate—views which can be applied to diseases which originate in contagion, but certainly not to the numerous morbid conditions which are the result of changes in the nervous and vascular systems.

A NEW CAUSTIC IN OPHTHALMIA.*

BY M. CHASSAIGNAC.

M. CHASSAIGNAC had the idea of mixing different caustic metallic salts with various proportions of powdered gum, and forming them into a mass with water. This paste is rolled up and cut into the form of a crayon, which, when dried, becomes hard. It is fixed in a common porte-crayon, and employed in the same manner as *lapis infernalis*, in certain chronic affections of the conjunctiva and cornea. He also possesses a composition having a less caustic action than the pure salt, and capable of being graduated at will.

ON LAND SCURVY, PRODUCED BY EATING DISEASED POTATOES.†

BY M. J. M'CORMACK, M.D.

I HAVE below detailed a case of what I believe to be a new disease in this country, and which I have not the least doubt arose from the use of diseased potatoes. As I am not aware that there is any description of such an affection to be found in any of the medical works of this country, the reasons which have led me to designate this disease by the name of land scurvy, originated from the striking similarity which exists between it and a disease to which the same name has been given by the gentlemen who have described it in the *Transactions of the Medical and Physical Society of Calcutta*.

CASE.—March 24th, I was requested by a poor man, residing about half a mile from this town, to see his daughter, aged sixteen, who, he stated, had got the "complaint" that was going through the country. He described it as having begun with a pain in two of her front teeth; after producing great swelling of the gums, it "had fell in her head," which, he said, was enormously swollen. Her occupation was that of a factory-girl in a flax-mill, where she was exposed to great and sudden changes of temperature, also to great fatigue, the heat of the mill being so intense that her clothes were always saturated with perspiration. Her hours of work were from half-past five in the morning till past seven in the evening. From the extreme wretchedness of the family, her food had been of the most scanty and unwholesome nature, the potatoes they used being all more or less diseased, and milk being an article of diet they had not been able to indulge in for months. She complained, for about fourteen days, of a

* *Annales de Therapeutics.*

† *Lancet.*

pain in two of her front teeth, which was of so acute a character as to preclude sleep at night, and caused equally intense suffering during the day; also of chilliness, and disinclination to move or exert herself. Still she struggled up against the disease, as both herself and her family were dependent for livelihood on her earnings; and she continued going to the factory until eight days ago, when she was unable to quit her bed from excruciating pain in all her joints, and in the small of her back, and burning heat of skin. She had now not slept for several nights, during which, her mother says, she raved incessantly; had not been able to eat any food for four days past, from the soreness of her gums, mouth, and throat; had felt a sense of weight, accompanied with pain, in the region of the heart; palpitation excited by the slightest movement; general muscular soreness over the whole body.

Present symptoms.—The pain in her teeth is now excessive, and has continued so for the last fourteen days; no appearance of caries in any; the gums, especially of the lower jaw, are swollen, painful, spongy, and bleed on the slightest touch; even the attempt to swallow causes an oozing of blood. On examining, I found the gums as described, the teeth loose and extremely painful; fauces and mouth inflamed, and ulcerated in patches; tongue flabby, and thickly loaded with white fur; breath horribly fœtid; great difficulty in swallowing; pulse 130, small and feeble; muscular pains excruciating; joints swollen and very painful; skin over the whole body tense, tumefied, and of a preternaturally dark colour; vibices scattered over the limbs; great prostration and despondency; constant involuntary sighing; face and head enormously swollen; countenance pallid, unmeaning, and indicating indifference of her fate; no sleep, from the pains of the joints. The bowels had been obstinately constipated for several days, and the mother had given her a dose of senna and salts, the evacuations caused by which brought on such extreme exhaustion that she thought she was dying, having had several fainting fits in rapid succession. Urine scanty and highly coloured; the belly hard and dropsical; heat of skin intense; has had no medical advice. The two teeth in which the pain commenced have split in two perpendicularly.

Of the treatment, I shall at present say nothing more but that it consisted of all the remedies, both medicinal and dietetic (as far as circumstances would allow), which will be described as having been used in the disease as it appeared in India; and all failed to produce more than temporary relief.

PRACTICAL REMARKS ON SOME POINTS OF TRICHOPATHY AND THE CHEMICAL PATHOLOGY OF THE HUMAN HAIR.*

BY THOMAS CATTELL, ESQ., M.D.

No reply having yet been furnished to the wish of a subscriber expressed in *The Lancet* of 28th March last, "on the ingredients used, and the practices adopted, in dyeing the hair," I am induced to enter upon some consideration of the subject.

In this are necessarily involved, tricho-dyschroia, decoloration; tricho-crosology, coloration; and the general pathology of the hair. The only other trichopathical affections to which I shall here refer are, allopecia, canities, and calvities, or baldness, hoariness, and fall of the hair.

Tricho-dyschroia is a pathological condition of the hair, which may arise from constitutional changes induced by inadequate diet or disease, the influence of emotions and passions, hereditary influence, &c. There is, however, no cause so manifest as that of chemical reagency in decolorising the hair; for example, if the hair of a person be for some time exposed to gaseous chlorine, its natural colour disappears, and there is perceived the presence of a bitter adhesive compound. That systemic changes, ushered in by the constant use of a diet, deficient in the elements of the hair, may alone, or associated with physical affection, stand as the proximate cause of tricho-dyschroia, is a point, to say the least, which theory justifies us in supposing. In corroboration of the supposition, that tricho-dyschroia is often induced by the direct and powerful influence of emotions and passions, there are not wanting the record of many striking coincidences.

It is, I believe, generally admitted, that old age is an essentially proximate cause of tricho-dyschroia and canities. But to establish the hypothesis, it is necessary to prove that such is uniformly the case. To suppose otherwise, is to suppose this essentiality no essentiality, which is a contradiction. We cannot speak of the cause of a physical change as essentially proximate, unless we admit the uniformity of this cause. To affirm, therefore, that old age is the proximate cause of either tricho-dyschroia or canities, is to affirm what is directly contravened by the evidence of numerous facts; still, it is perplexing to offer a solution of the absolute cause of that change which so often occurs in the extremes of apparent juvenility and real decrepitude. We are, however, confi-

* *Lancet.*

dent that the effect is the same, whether it occur in the ascension, meridian, or declination of life, as the chemical pathology of each will give us no room to doubt. It is scarcely necessary to observe, that hereditary influence greatly modifies the colour of the hair.

With this slight reference to the causes which operate in producing changes, varieties of colour, and conditions of the hair, it is here incumbent that we should inquire what, in a chemical view of the case, constitutes the nature of such changes, varieties, and conditions.

Vauquelin asserts, that the varieties in the colour of the hair depend on the presence of a coloured fatty matter; but such notion appears to be controverted by the fact, that black hair chiefly recognises for its colour the existence of iron in a state of sulphuret. If this coloured fatty matter be the proximate cause of all the varieties in the colour of the hair, then it is evident, that of what colour soever this fatty matter is, so must be the colour of the hair. Besides, the supposition is opposed to much factorial evidence. For example: if we take hair, exhibiting the different varieties of black, auburn, red, or brown, and by chemical reagents deprive it of its sulphur or iron, we deprive it of these colours or varieties. How could this be, if the colour in all its varieties depended entirely on the presence of a fatty matter. Again, if we apply to the hair stains of lead or silver, or silver with iron, we immediately recognise a change of colour. What is the cause of this change? If it be dependent on the fatty matter, then must this fatty matter assimilate the new colour, and produce such change. But such cannot be the case, though we suppose the sulphur which combined with the metallic oxide existed in the fatty matter.

It is, then, I think, the existence of sulphur in the hair, and not the presence of any supposed coloured fatty matter, that may be considered the cause of all the varieties of its colour. And this probably not on the mere fact of the existence of sulphur in the hair, but from a variation of its quantity in different hair.

Besides, this opinion may receive additional corroboration from evidence negative as well as positive—that is, suppose we deprive the hair by any means of its sulphur, or suppose the sulphur non-existent in the hair, of what colour would it be, or of what utility would it be, to apply in any case stains of silver, lead, or silver with iron?

The supposition, that the relative quantity of the sulphur of the hair to the metallic oxide constitutes the proximate cause of all its natural varieties of colour, is, moreover, warranted by the fundamental principles of chemistry; for if all substances combine in definite proportions, and if the colour of the hair be dependent on the presence of a metallic sulphuret, may we not rightly pronounce, that in proportion to its relative quantity and diffusion, will be variety or degree of colour?

Tricho-crosology is a compound Greek term, which I have devised appositely to express the chemical processes employed in reducing some of the unseemly varieties of colour to which the hair is subject, to a supposed standard or standards of natural or ideal beauty. These embrace the formation of paste, pommade, and liquid.

I. PHUMAFORM HAIR DYE.

1. Oxide of lead, three ounces; carbonate of lime, two ounces; mix into a proper consistence with hot water, and apply it to the hair enveloped in oil-skin.

2. Carbonate of lead in the place of the oxide of lead, and proceed as in the other case. The efficacy of this stain depends on the formation of a plumbite of lime.

II. STEARIFORM HAIR DYE.

Nitrate of silver, a drachm; nitric acid, two drachms; iron filings, two drachms: mix. After the lapse of a few hours, pour the supernatant liquor on two drachms of oatmeal. Lastly, well mix with three ounces of lard.

III. CHULOSIFORM HAIR DYES.

1. Silver, two drachms; iron filings, half an ounce; nitric acid, one ounce; water, eight ounces: mix. When the metallic substances are dissolved, pour off the supernatant liquor, which constitutes the dye.

2. Nitrate of silver, eleven drachms; nitric acid, a drachm; distilled water, twenty ounces; soap (*sap. viridis*), three drachms; gum-arabic, a drachm: well mix.

3. Nitric acid, a drachm; nitrate of silver, ten drachms; soap (*sap. viridis*), nine drachms; mucillage, five drachms; water, thirty-seven ounces and a half: mix. This differs from the foregoing only in proportions.

4. Lead filings, two ounces; hartshorn shavings, an ounce; oxide of lead, two drachms; camphor, a drachm; water, a pint. Boil for half an hour, and when fine, pour off the supernatant liquor on di-acetate of lead and rosemary leaves, of each one drachm. Again boil, and when sufficiently fine, pour off the supernatant liquor, which constitutes the dye.

Of these preparations, as stains for the hair, none claims so decided a preference as

the last. It can produce injury to neither the hair, skin, nor brain, and possesses the advantage of communicating a beautiful colour and curling property to the hair. Whatever objection there may be to the use of dyes containing the nitrate of silver, from their liability to darken the skin, still I regard them preferable to the employment of caustic earths, owing to the depilatory action of the latter.

Before the application of any liquid stain, it is necessary that the hair be freed from all greasy matter. A close brush and a comb are all the requisites in staining the hair.

Connected with the general pathology of the hair, the only two points to which I shall now refer are allopecia and calvities—baldness and fall of the hair.

Allopecia may arise from any cause destroying the vitality of the bulb of the hair—as, various fevers, the wearing silk hats, the existence of what, in common parlance, is called a worm at the root, neglect in cleansing the head, &c.

Calvities follow precisely analagous causes, and merely differs from allopecia in degree.

To remedy these affections, it would appear, by our daily advertisements, that every advertiser had discovered some secret process—had, in fact, ransacked the whole arcana of science. But leaving these, and the victims that use them, I will mention a general remedy or two which will be found uniformly efficacious, and infinitely more satisfactory in their results then bears'-grease, Macassar oil, or any other advertised preventive or curative:—

1. Rosemary, maiden-hair, southern-wood, myrtle-berries, hazel bark—of each two ounces. Incinerate, and with the incinerated substance make a strong ley, with which to wash the hair at the roots every day. Keep the air out short.

2. Carbonate of potash (pearlash), two drachms; water, a pint, use as the preceding. The efficacy of both these remedial applications depend upon their alkalescent character.

But where a greasy substance is required for the hair, I would suggest the substitution of the elaine of olive oil; though expensive, it will, in many cases, well repay the use, as it never thickens, engenders scurf, or in any way produces detriment to the hair, like common oil or pommade.

The only other greasy matters which I would suggest as substitutes for the elaine are ox-marrow, well agitated in a mortar, and castor-oil, freed of its adhesive matter.

I trust that, for the future, professional men, and not nostrum-mongers, will take charge of the diseases and affections of the hair.

ON THE ADULTERATION OF CAMPHOR BY SAL-AMMONIAC.*

BY M. CH. GOBIS.

M. GOBIS purchased in the market a quantity of camphor, consisting of large pieces, and a considerable quantity, also, much bruised. Its dull and gray colour caused him to suspect that it was not pure. After examining it attentively, he observed that the large pieces had no peculiar characteristic, but that the small ones were formed of different layers, which were not of the same structure, or even colour. When submitted to the action of heat, they were completely volatilised, triturated with a few drops of alcohol, they were reduced to powder, but with great difficulty. They were then dissolved in about half their quantity, by weight, of alcohol, still, however, depositing a small quantity of a white precipitate, which, after being collected on a filter, and washed in a little alcohol, was dissolved in distilled water, and comported itself in the presence of tests like the hydrochlorates. Reduced to powder, and triturated with a small quantity of potash, the adulterated camphor gave out ammoniacal gas. It was, therefore, evident it contained sal-ammoniac.

THE STOMACH AND INTESTINES A RESPIRATORY SURFACE, BEING THE CAUSE OF THE BLOOD'S CIRCULATION THROUGH THE LIVER.†

BY CHARLES SEARLE, M.D.

THE powers for circulating the blood through the system are now, I believe, pretty generally acknowledged to reside in the heart, in its twofold capacity of a forcing and a sucking pump, and in the action of the capillary vessels. The left ventricle propelling the blood through the arteries by its contraction, and the auricle by its dilatation, (and the partial vacuum formed by the expansion of the chest, and atmospheric pressure *ab externo*), aids it in its return by the veins, into which it is first conveyed by the excitement imparted by the arterial blood to the capillary vessels. I say, by the stimulus of the arterial blood on the capillary vessels; for these are found to accord in action with the respiratory function, capillary excitement being the result of chemical action, developed by the agency of oxygen in its combination with the elements of the blood.

Such being the circulating powers, it has

* *Journal de Pharmacie*

†*Lancet.*

ever been a matter of astonishment with me, how the blood could be circulated through the liver, seeing that these powers were wholly inoperative with respect to the liver, or nearly so. Light is at length, I am of opinion, thrown upon this matter. I believe I can now see clearly what heretofore has been a matter of much doubt and difficulty to me; and this I now beg leave to submit to the notice of the profession. The action of the heart, I repeat, must be wholly inoperative, or nearly so, in the blood's circulation through the liver, and the blood furnished to the liver being at the same time venous, the united streams brought by the veins of the stomach, bowels, spleen, and pancreas, and associated in the portal vein, must be equally inoperative as regards the capillary vessels. Well, how then is the circulation effected? Simply by the surface of the stomach and bowels being a respiratory surface, and thus imparting (by the oxygen absorbed) the vital qualifications necessary for the blood proceeding to the liver; but first circulating on their surfaces, and to the alimentary juices also absorbed from these surfaces. The alimentary material, moreover, in its passage to the stomach, being first masticated, is mixed with the air of the mouth; air, too, being constantly swallowed with the saliva, is received into the stomach, in combination, also, with water—man's proper beverage, in common with the rest of the animal creation. Here, I should say, was an abundant source of power for actuating not only the capillary vessels of the liver, but the lacteal absorbent vessels also, vital action being thus imparted to these vessels by their fluid contents, in a like manner, as to the capillaries of the arterial system. These views are borne out by the analyses of Majendie, who found oxygen in combination with nitrogen in the stomach of an executed criminal, but no oxygen in the bowels. And thus, also, the purpose of chewing the cud in ruminant animals, which are all herbivorous, and require, therefore, from the increased volume of food necessary for them, a more active condition of the absorbing and hepatic functions, and by remasticating their food, are accordingly so furnished. At the same time, the product is further animalized by receiving an accession to it of nitrogen also. These views are supported, again, by the fact, that herbivorous insects have, in substitute for this power of chewing the cud, air-cells diffused over their body, in addition to the spiracles which are common to insects.

If, sir, these views are correct (which I am of opinion can hardly admit of doubt), how many important deductions with reference to health and disease arise out of them! I shall at present only mention one, which involves an argument of the highest importance in favour of temperance and cold water. It is known that fish and aquatic animals are maintained in vitality simply by the air contained in the water they inhabit: boil the water, and its vital properties are dissipated. With this fact before us, and seeing that half the population never allow a drop of water to enter their stomach which has not been boiled, or contaminated in some way or other, is it surprising that constipation, or torpor of the stomach and bowels, or liver, are of such frequent occurrence? And, in a moral point of view, could any fact be adduced half so cogent in favour of unsophisticated cold water as man's best beverage, than the one I have given, namely, its power of adding vitality to the blood?

CAOUTCHOUC, A REMEDY AGAINST THE TOOTH-ACHE.*

Caoutchouc, which softens and becomes viscous by the application of heat, has been proposed by Dr. Rolffs as an excellent means for filling the cavities of carious teeth, and relieving the tooth-ache arising from that cause. He fixes a piece of caoutchouc to the end of a wire, melts it by the flame of a candle, and pressing it, while yet hot, into the cavity of the tooth, the pain is instantly relieved. Great care, however, must be taken to clean out the cavity, in the first instance, with cotton. The viscous and adhesive nature of the caoutchouc preserves the denuded nerve from the action of the air, and thus removes the cause of the tooth-ache.

THE USE OF CHARCOAL IN THE TREATMENT OF CONSUMPTION.†

This substance is recommended by a writer in the *Boston Medical and Surgical Journal*, as a therapeutical agent. The remedy may deserve a trial midst the thousand and one others which claim attention.

"Within the last two years, the writer has prescribed charcoal as a tonic, and with such well-marked good results, especially in cases of consumption, that he is induced to invite medical practitioners to test its remedial powers, and report their experience, even should they not find it so well deserving of attention, as he has been forced, from a close observation of its effects, to consider it.

"In six cases of tubercular consumption

* *Journal de Pharmacie.*

† *Lancet.*

in which it has been used, and in which the writer had frequent opportunities of witnessing the results that followed its administration, he is satisfied that it possesses the power of lessening profuse sweats, and of resisting emaciation. He will not claim for it the virtue of entirely arresting the former, or completely preventing the latter symptom of phthisis; although, in one of the cases in which it was given, the symptoms alluded to were arrested from the commencement of its exhibition; and increase of flesh was plainly manifest, after a few weeks of its continuance.

"In two of the cases the tubercular irritation is suspended. The patients believe themselves to be entirely free from disease, after having been so much reduced as to be obliged to confine themselves, almost constantly, for a number of weeks, to their beds, and having suffered for months from all the characteristic symptoms of tubercular phthisis—a disease which had proved peculiarly fatal in each of the families of which the individuals referred to were members.

"The charcoal has usually been directed to be taken finely powdered, in drachm doses, three times a day; and whenever it appeared to occasion the least irritation to the bowels, a few drops of paregoric have been administered with each dose. On the other hand, costiveness has been obviated by combining with it, occasionally, a few grains of rhubarb."

AMMONIA AS A REMEDY IN ASTHMA.*

M. Rayer has recently published his experience of the effects of a strong solution of ammonia applied to the velum palati for the cure of asthma. M. Monneret and others had previously employed this mode of treatment, but they applied the caustic to the back part of the pharynx, and in some instances death had nearly ensued from suffocation, owing to the action of the volatile alkali on the glottis. M. Rayer's method of employing this remedy is as follows:—He dips a roll of lint, about the length of the middle finger, in a mixture of four parts of strong aqua ammoniæ and one of water, pressing out the superfluous liquid, and immediately applies it, for a few seconds, to the velum palati, as if about to cauterise the part. The patient is immediately seized with a feeling of suffocation; a fit of coughing ensues, with much expectoration, and this is soon followed by a great feeling of comfort, and facility of respiration. Should any return of the fit occur on the day following, the ammonia is again applied. The degree of tolerance of this remedy by patients varies very much; it is therefore always well to use it weak at first, which is easily done by moving the piece of lint, dipped in the solution, three or four times rapidly through the air, and then smelling it, when the strength is readily ascertained. In M. Rayer's experience, extending to over a hundred cases, a single application rarely failed to afford relief, and in many instances prevented a return of the attack for three or four months. This mode of treatment is alone applicable to simple or idiopathic asthma, that form which is so often dependent on emphysema, and is attended with catarrh; it has, nevertheless, afforded relief in some cases of symptomatic asthma.

* *Dublin Journal.*

ADVANTAGEOUS METHOD OF PREPARING GALLIC ACID.*

BY F. MUELLER.

The author recommends Braconnot's method for preparing gallic acid, modified as follows. He boils 16 oz. of coarsely-pounded so-called heavy blue galls 3 times with 8 lbs. of water in a tin saucepan, strains the decoction, and lets it stand for 4 months in a covered earthenware pan, at a temperature of 100°—122°, now and then replacing the evaporated water and well agitating. The mould, as well as the crusts which formed, are after this time collected on a filter, slightly washed with cold water and dried, then boiled with 4 parts water, filtered, and the residue well washed with hot water. The crystals which separate from the filtered solution on cooling are separated from the mother-ley, slightly washed, dissolved in a little boiling water, and set aside to crystallise. The crystallised acid is collected on a filter, rinsed once or twice with water, dried, then digested for several days with 3 oz. of alcohol and 1 oz. of purified animal charcoal, heated to boiling, filtered, and evaporated at a very gentle heat. The still slightly brownish crystals are again collected on a filter, rinsed with spirit, dissolved in 3 parts boiling water, and set aside to crystallise. The crystals now obtained were of a beautiful white colour, silky lustre, and perfectly pure. The mother-ley yielded on evaporation a small quantity of brownish-yellow crystals. The produce in beautiful white gallic acid amounted to 2½ oz. In another experiment, 3 lbs. of galls yielded 8 oz.

* *Archiv. der Pharm.*, xlvi. p. 153, and *Chemical Gazette.*

AMORPHOUS QUININE.*

BY DR. NATORBS.

You tell me that you are desirous to know whether I continue to employ the uncrystalline alkaloid of the cinchona bark, and what are the results of my experience respecting the therapeutic effects of this remedy. In answer to your inquiries, I am happy to communicate the following effects:—

The late Mr. Reidel, pharmaceutical chemist, was largely engaged in the manfacture of the various preparations of cinchona bark, and he obtained an uncrystallisable residue, incapable of further purification. Thinking that this substance might be employed as a remedy, he furnished me with a considerable quantity, for the purpose of making experiments in my practice amongst the poor peasantry. It happened that just at that time an epidemic intermittent fever was raging in Berlin and the neighbourhood, which gave me a most favourable opportunity of testing its anti-intermittent power; and I was quite astonished at the extraordinary effects of this new substance. Another physician, Dr. Skilling, physician to the forces, made at the same time similar experiments with it, and obtained the same results. As the fever was excessively prevalent in the villages around Berlin, many of the proprietors to whom I am physician applied to me to furnish them with a remedy against the disease. I prescribed the new substance in question, in solution, as I will presently explain; and the result was, the rapid disappearance of the malady from their estates. The reputation of these cures at that time extended so far, that the peasants came from forty-five to fifty miles' distance to fetch 'the fever-drops.' One proprietor of a large estate near Warsaw, hearing that an epidemic fever had broken out amongst his peasantry, forwarded large quantities of the fever-drops, and he was soon gratified with the intelligence that the use of this remarkable remedy had been attended with immediate success.

I now employ this substance only, to the exclusion of all other preparations from bark, quinine, &c., in all cases of intermittent fever; and I can boldly assert, that in the experience of many years it has never disappointed me. It has this great and inestimable advantage, that one can determine with absolute certainty, by administering it, that the recurrence of the attack shall be prevented. No other preparation of bark, and no other remedy that I know of, will enable us to say with positive certainty that the next expected accession shall not take place. Moreover, it prevents the occurrence of relapses, more than any other febrifuge; and in many thousands of cases in which I have had occasion to employ it, I have never seen the cessation of the fever followed be unpleasant sequelæ. My way of prescribing this remedy is, in a spirituous solution, of which I mix one ounce, with acid of Haller, a drachm; peppermint-water, three ounces. Of these drops, I give in quotidian fever a teaspoonful every hour from the commencement of the perspiration; in tertian, one every two hours; in quartan, one every three hours.

When the attacks have ceased, which I feel almost inclined to assert is uniformly the result of the administration of this remedy, I always give a teaspoonful of the above mixture every night and morning, until there is no longer any fear of a relapse.

I have also experienced the efficacy of this remedy in fevers of a sporadic origin; and I and many physicians of Berlin employ it as a tonic in all cases where we used to prescribe any of the other forms of bark.

I will not presume to pronounce on the chemical nature of this uncrystalline body. I suspect that 'chinoroth' plays an important part in it.

Should you deem any further or more minute information respecting this matter desirable, I shall be happy to supply you with all I know. You are at liberty to publish or make what use you think proper of this communication.

I may add, that this substance will be introduced into the next edition of the "Prussian Pharmacopœia."

* *Lancet.*

MISCELLANEA.

ELECTRIC CLOCK.

The public is aware of Mr. Bain's invention of the electric clock, which derives its motive power from currents of electricity in the earth. Mr. Bain has invented and patented another kind of electric clock, which we had lately the pleasure of examining when it was exhibited here by the inventor to a few scientific gentlemen—the clock being in Glasgow, and the pendulum in Edinburgh! By means

of the electric telegraph along the railway constructed by Mr. Bain, he intimated his wish that the pendulum at the other end of the line should be put in motion. The answer was given with the rapidity of thought; for the machinery in the clock instantly began to move. To be more particular: the clock was placed in the station-house, in Glasgow—the pendulum belonging to it in the station-house at Edinburgh—the two being forty-six miles apart. They were joined by means of the wire of the telegraph, in such a manner as that, by a current of electricity, the machinery in the clock in Glasgow was made to move correctly according to the vibrations of the electrical pendulum in Edinburgh. Thus, in like manner, Mr. Bain informed us, were England and Scotland united in one grand chronometrical alliance, a single electrical pendulum of this description placed in the Observatory at Greenwich, would give the astronomical time correct throughout the whole country.

EXPULSION OF GAS FROM MINES.

A METHOD of expelling carbonic acid gas from pits, mines, and reservoirs, has lately been projected in France by M. Faucille. It consists in discharging among the gas a volume of steam, whereby the gas is in part expelled, and in part absorbed by the water brought into minute subdivision while the steam is being condensed.

THE COPPER, BELL METAL, AND BRONZE COINAGE OF FRANCE.

BY M. PÉLOUZE.

THE nominal value of this circulating medium is estimated at 30,000,000 of francs. Of the total weight, the sous, according to M. Pélouse, amount to 6,191,100 kilogrammes; and, as his analysis gives him for copper coin 929 of copper to be 1,000, he estimates the total weight of copper at 5,739,750 kilos. M. Pélouze divides the copper, or mixed coin of which copper forms the base, into three classes. The first comprises the red sous of the reigns of Louis XV. and Louis XVI. They contain 995 of pure copper to the 1,000. In the second class he ranges the two sous pieces of bell-metal, copper, and tin. His estimate of the copper is 860 to the 1,000. They contain also a very small portion of zinc, lead, and antimony, and sometimes traces of iron and arsenic are found in them. The third class consists of the red sous and double sous, with the effigy of liberty. These contain 960 parts of copper to the 1,000.

THE CLIMATE OF CHINA, AND ITS EFFECTS ON THE HUMAN CONSTITUTION.

BY WILSON RAMSAY.

THE following letter on the subject of Mr. Walsh's communication respecting the island of Chusan, which appeared in our last number, is copied from the *Lancet* for July 11.

From having been a constant resident at the different stations on the east coast of China for more than three years, in charge of from three to upwards of four and five hundred persons, of both sexes, and of all nations, I may, perhaps, through your kindness, be permitted to offer a few remarks dissentient from Dr. Walsh, since his observance of the disease of which he has written, was not, according to his account, confined to Chusan, but appears to have extended its consequences to the entire coast.

I doubt not the accuracy with which Dr. Walsh has described this disease; but it certainly never made its appearance, during the time I was in the country, on any part of the coast at which I was at any time stationed.

In the great majority of hepatic and intestinal diseases which came under my notice, the superfluity of bile more particularly attracted my notice and demanded my attention.

In the peculiar type of fever which existed throughout the entire of the south-west monsoon, the contents of both the stomach and intestines were uniformly more or less mixed with bile of a thicker and more gelatinous consistence than is natural; and these appearances were not confined to any particular class of persons. Natives of India, Malacca, Java, Manilla, New Zealand, America, and Europe, all suffered equally.

I am not, unfortunately, sufficiently well versed in natural philosophy to enter into the interesting facts detailed by Dr. Walsh relative to electricity. If, however, those of its passing *from* west *to* east, and of water being its best conductor, are confirmed, I should be led to suppose that the east coast of China would not be much under its influence, since no part of the Asiatic continent except its eastern and southern boundaries are in contact with the sea.

A very little observation is necessary to remark the differences in the complexions which exist amongst the natives of the different provinces, as we go from south to north.

Exposure to the sun has, undoubtedly, a great effect in rendering those whose occupations oblige them to submit to its influence much darker than their more opulent bre-

thren; but it is as undoubtedly the case, that the use of opium and chalk, both of which are used in large quantities, are productive of the "waxy complexions" which Dr. Walsh mentions. (The latter, it may be observed, is used by the women to produce an artificial whiteness of the exposed parts of their bodies.)

Whiskers are by no means so uncommon as are generally supposed, but when they appear they are carefully plucked out; and if I can judge of the virility of the Chinese by the prodigious numbers of children (not taking into account the numbers of females which are doomed to death) which every even insignificant village produces, I cannot believe that the east coast of China suffers much from the effects of negative electricity.

ANCIENT GLASS, AS APPLIED TO DOMESTIC PURPOSES.

At a late meeting of the Freemasons of the Church, Mr. George Isaacs delivered a lecture on ancient glass as applied to domestic purposes. After alluding to the arts of forming and colouring glass vessels among the Egyptians, Mr. Isaacs explained the nature of their manufacture, and described many of the finest known specimens in existence. Following the art through the histories of Tyre, Sidon, and Etruria, he proceeded to the period of Greek art, on which he dwelt at some length, adverted then to the Portland vase, some specimens in the Bibliotheque Royale, and those exhibited at the last meeting by the Earl of Cadogan, in all of which examples, it seems conclusively demonstrated that the glass was blown of two colours, viz., of deep purple coated with white, and that on the exterior surface were carved those exquisite bas-reliefs, which, from their extraordinary delicacy and precision, have been an enigma to antiquaries of considerable authority. A wonderful specimen of Greek art, in the possession of Mr. Herley, was then described, having a series of gold figures burnt in from the interior of the vessel, and some curious information was given on the subject of malleable glass from Dion Cassius, Petronius, Arbiter, and Isidorus, Ibn Abd Alnolm, Nero, and many other writers. The composition of malleable glass was said to have been discovered in France some months ago, and various paragraphs appeared in the public journals announcing the discovery, but latterly nothing has been heard upon the subject. The removal of the excise duty, however, will cause the manufacture to advance with giant strides.

ARTESIAN WELLS, NEAR LONDON.*

At a meeting of the Instititution of Civil Engineers, on the 30th June, a paper was read, describing the "Effect of the deep Wells of the Metropolis on the supply of Water in the London Basin," by F. Braithwaite, Esq. The object was, to direct attention to the fact, that the numerous deep wells sunk in and near the metropolis are gradually draining the chalk basin; and that every additional well driven in search of water has the effect of diminishing the water level in all the wells already existing. As a proof of this fact, it was stated that, in a well at Combe's Brewery, sunk 20 years ago, the water rose at that time to within 70 feet of the surface, but that it now only rises to within 120 feet; showing a diminishing of 50 feet. From this and other instances, it was argued, that the supply of water is rapidly decreasing; and this was attributed as well to the improved under-drainage of the lands which receive the falling rain, as to the increased demand upon the springs. It was thus shown, that the deep springs are not inexhaustible, and that obtaining water from them is attended with considerable expense and uncertainty. It was argued, thence, that it is necessary to consider very carefully any attempts for obtaining a considerable supply of water from the chalk of the London Basin. A remarkable fact, also shown in one of the tables, is, that, on the 5th of April, 1832, there occurred a sudden depression, of 18 feet, of the springs, which lasted for half an hour; at the end of which time, 13 feet of the 18 were regained. The paper contained many interesting facts as to the general amount of the supply of water from the different strata; and was illustrated by a series of plans—the first of which was a map, on a large scale, taking St. Paul's as the centre, and describing around it a series of circles, with a radius of four miles. The external circle was divided into the 32 points of the compass; from which lines were drawn to the centre (St. Paul's). Upon these lines a series of sections were laid down, exhibiting the various strata down to the chalk, as shown by the deep wells sunk in the districts between those lines, as far as the information could be gathered from those employed in sinking and boring them. These sections exhibit a remarkable contour of the chalk basin; and furnish fertile subject for speculative geology, as well as very valuable information as to the probable production of water from the various strata. In the discussion which ensued, the Dean of Westminster treated, with

* *Athenæum.*

his usual clearness of scientific research, the difficult problem of the origin of subterraneous lakes or sheets of water, and the causes of the spontaneous ascent of the water towards the surface of the earth. He described the influence of the alternating impermeable beds of clay in retaining within the more porous strata the water received at their out-crop; whence, it became evident, the cause of the spontaneous rising of water in the artesian wells sunk through the impermeable London clay down to the porous chalk basin into which the water had filtered, through the fissures and veins of flints, from the extensive denuded surface of chalk around the London district. After treating this subject at considerable length, the Rev. Doctor alluded succinctly to the proposed speculation for supplying the metropolis with water from the River Colne; and described the labours of the Rev. Mr. Clutterbuck, who, in papers read before the Institution, had demonstrated, by a long-continued series of measurements of the water in the chalk hills of Hertfordshire, that all the water taken from that neighbourhood would have been abstracted from the supplies of the river Colne, and would have trenched upon the water rights of the mill owners. He alluded, also, to the rain-gauge experiments of Mr. J. Dickenson; who, during many years, had found by arithmetical evidence that the quantity of summer water in the river Colne varied with the quantity of rain in the preceding winter; and regulated his contracts for paper to be manufactured in the summer and autumn by the quantity of water shown in his winter rain-gauge. These observations have been corroborated by foreign experiments. He then treated briefly the general subject of artesian wells—the increased temperature of the water in the exact ratio of their depth—the sympathy between the depression of water in the various wells throughout an extensive chalk district, proving the identity of origin of the supplies. As, therefore, the number of deep wells was constantly increasing, the extra pumping upon one of them necessarily affected all within a certain distance around it. Mr. Clutterbuck's observations confirmed this. He had further observed that the surface line of subterranean sheets of water was not horizontal, but inclined at a considerable angle, in consequence of the friction of the strata through which the water descended. The Dean concluded by drawing attention to the remarkable contour of the surface of the chalk exhibited in the sections, upon which he proposed on a future occasion to offer some observations.

THE TEA PLANT.

At a meeting of the Paris Academy of Sciences, a letter was read from M. Lecoq, in which he shows the possibility of cultivating the tea plant in France. The mere cultivation of the plant in that country is, we believe, a matter of no difficulty; the main point is to produce tea with the aroma peculiar to that of the Chinese, who appear to possess some secret which has not yet been revealed. The English, who have introduced the tea plant to the Mauritius, and even the Brazilians, who have so propitious a climate for the growth of tea, have not succeeded in obtaining this aroma, which is said to depend considerably on the preparation of the leaf. Such, at least, is the statement of M. Lecoq, who says that he is able, by his mode of preparing tea grown in France, to produce as fine qualities as the best that are imported from China. He has forwarded samples to the Royal Society of Agriculture, and we shall probably soon have the report of that body on this subject, which is really one of importance.

ARTIFICIAL ASBESTOS.

A specimen of this substance was found in a blast furnace, imbedded in the mass of matter which had collected at the bottom of the furnaces, in the course of two years and a half. It was in a cavity about eight inches below the level on which the liquid metal rested, and was interspersed with beautiful crystals of titanium. It has the general character of asbestos, forming small masses, consisting of delicate filaments or fibres easily separable. The fibres are flexible, though not so much so as common asbestos; they fuse with difficulty, and are not attacked by sulphuric, nitric or muriatic acid.

SINGULAR THUNDER CLOUD.

M. Arago, in his observations on thunder (*Annuaire du Bureau des Longitudes* for 1838), relates four instances of small isolated clouds, in a clear sky, producing thunder. "To these instances," observes M. Duperrey, of the Academie des Sciences, I can add a fifth, of which I was myself a witness. In 1818, being between the islands of Timor and Ombay, we saw one evening a small white cloud, suddenly launching forth thunder on every side. It rose slowly, notwithstanding the force of the wind, and was separated by a great distance from the rest of the clouds, which latter remained stationary, and as if fixed in the horizon. The small cloud was round, and might occupy a

space equal to the apparent magnitude of the sun. Zigzag lightning burst forth on every side, and a series of successive detonations exactly resembled the sound produced by the musketry of a battalion firing at random. This phenomenon did not continue for less than half a minute, and the cloud completely disappeared along with the last detonation.

AMERICAN GOLD MINES.

The produce of gold in the two Carolinas is on the continued increase. The quantity brought into the Mint in 1843 amounted to the value of 272,000 dollars. The state has recently turned to account the sands of the river Catawba, flowing through the gold district. A private individual, named Gibson, has obtained from it the proprietorship of the soil lying *below* the waters of the stream. The sand is withdrawn from the bed of the river by means of long-handled ladles of peculiar construction, for which Mr. Gibson has taken out a patent. Each evening, the sand and gravel are washed on the banks, amalgamated by means of mercury, and the amalgamated gold forwarded to the mint, where it has been recognized as very pure. This gold seems to come from a mine of brown hematite, lying in the district of Centerville, near the Falls of the Catawba, and in the neighbourhood of a coal mine.

NEW REGULATION OF THE SOCIETY OF APOTHECARIES.

At a meeting of the students of University College, held on Wednesday, July 15th, 1846, for the purpose of considering the determination of the Apothecaries' Company, not to commence the registration of students till after August 3rd—Mr. J. E. Wood in the chair—it was proposed by Mr. Cook, seconded by Mr. Randall, and resolved unanimously:—"That this meeting, having obtained official intimation that it is the intention of the Society of Apothecaries to depart, this year, from their usual custom of registering the attendance of students on the summer courses of lectures, before the termination of the session, and to postpone the same until after the 3rd of August, begs hereby to express its deep regret that the Worshipful Society should so inconsiderately institute a regulation which will detain the students in London at an unnecessary expense and inconvenience, and deprive them of a portion of the short time allotted for relaxation, and for the enjoyment of the society of their friends."

Moved by Mr. Park, seconded by Mr. Lowe, and resolved unanimously:—"That this meeting desires, therefore, most respectfully to call the attention of the Worshipful Society to the foregoing resolution, and to solicit them either to continue the practice of former years or to adopt some other plan by which the vacation will not be encroached upon."

Moved by Mr. Ransom, seconded by Mr. Acland, and carried unanimously:—"That a committee of three gentlemen be appointed to transmit a copy of these resolutions, signed by the chairman on behalf of the meeting, to the Society of Apothecaries, and to receive their reply."

Moved by Mr. West, seconded by Mr. Webb, and carried unanimously:—"That the committee transmit a copy of these resolutions to the Editor of the *Lancet*, with a request that he will use his influence in support of their objects."

REVIEW.

A HISTORY OF INVENTIONS, DISCOVERIES, AND ORIGINS. By John Beckmann, &c. Fourth edition carefully revised and enlarged. By Wm. Francis, Ph. D., F.L.S., and J. W. Griffith, M.D., F.L.S. Vol. 1. London: H. G. Bohn.

This new edition of Beckmann's well-known work, is a welcome addition to the popular scientific literature of the day; it forms one of the volumes of "Bohn's Standard Library." The work has evidently been very carefully revised, and such portions as the light of modern science has proved to be incorrect, have been expunged. In addition to this the work contains many valuable notes and additions, in which more recent discoveries and observations are carefully recorded. Altogether it is one of the most readable books we have recently met with.

TO CORRESPONDENTS.

"Cato"—We refer our correspondent to page 19 of *The Chemist* for 1845.

"J. Brooks" (Leeds)—The mode of preparing Ebelman's Silicic Ethers has been already described at page 175 of the present volume of *The Chemist*.

"H. S." (Croydon)—Certainly not; it occurred in the year 1839.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month, Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

CHEMICAL NOMENCLATURE AND CLASSIFICATION; TO WHICH IS ADDED, AN HISTORICAL LEXICON OF SYNONYMES, INCLUDING THE ANCIENT NAMES, THE FORMULÆ, THE NEW NAMES, THE NAMES OF THE AUTHORS, AND THE DATE OF THE DISCOVERY OF THE PRINCIPAL PRODUCTS OF CHEMISTRY.

BY FERD. HOEFER, DOCTOR IN MEDICINE.

The appearance, in 1787, of the *Nouvelle Méthode de Nomenclature Chimique*, was soon followed by the publication of several works, destined to extend the new chemical language, and at the same time to point out the modifications it was necessary to introduce into it. But these works have long been left behind by the rapid progress of science. The new impulse given to the study of chemistry by Messrs. Thénard, Gay-Lussac, Chevreul, Dumas, &c., in France; M. Berzelius, in Sweden; Messrs. Mitscherlich, H. Rose, Liebig, Wœhler, &c., in Germany; and Messrs. H. Davy, Thomson, and Graham, in England, have induced me to undertake the present work.

The first part, containing the nomenclature, classification, &c., will be particularly useful to those who are beginning to study chemistry.

The second part, comprising, under the title of "Lexicon," the present names, the formulæ, the old names, the authors, and the dates of each discovery, may be consulted with advantage, even by those who are already initiated in the science. It is by laborious research, alone, that I have succeeded in rendering this part of my work as perfect as I possibly could. In those cases where the documents are without the name of an author and the date of the discovery, I have preferred taking no notice of them, that I might avoid error. The exact determination of the formulæ presented difficulties equally serious. It could be wished that chemists would enter into some understanding among themselves, and adopt, uniformly, either atoms or equivalents, and not employ one or the other indifferently, as they do, in Germany in particular.

Finally, this work, such as it is, will, I hope, not only be useful to beginners, but of assistance to those who are advanced in their knowledge of chemistry.

CHAPTER I.—HISTORY OF CHEMICAL NOMENCLATURE.

Almost at the same instant as that in which the revolution of 1789 broke out, four individuals, Frenchmen, and men of genius, bestowed a new constitution on a science that prepares so brilliant a future for art and industry—Guyton-Morveau, Lavoisier, Berthollet, and Fourcroy, created the chemical nomenclature.

On the 18th of April, 1788, these illustrious chemists laid before the Academy of Sciences, a memoir, "On the necessity of reforming and perfecting the Chemical Nomenclature." This memoir was read before the Academy, by Lavoisier.

The necessity for such a reform had been long felt, for the ancient terminology adapted to the mystic doctrines of the black art, and alchemy, were more likely to impede than to facilitate the progress of science. This had already been clearly seen by Black and Bergmann. The latter had appealed to all the chemists in Europe, and called on them to substitute a new nomenclature in place of the eccentric denominations of the art of alchemy. "Show no favour," they said, "to any improper name; those who already understand, will still do so, and those who do not, will the sooner learn."

Guyton-Morveau, the translator of Bergmann's works, first answered the masterly appeal of Scheele. In 1782, he published his plan of reform, and had the modesty to solicit, not the approbation, but the objections of those who, at that time, cultivated the science of chemistry.

Morveau's memoir was inserted in the Abbe Rozier's "Journal de Physique," for 1782, p. 370, and entitled, "On Chemical Denominations, the necessity of perfecting the system, and the rules for attaining that

end." The following are the principles laid down in this memoir:—"1. The names of chemical products ought to indicate them on every occasion, without having recourse to circumlocution. 2. The denominations ought, in every case, to be in conformity with the nature of the objects. 3. When we have no certain knowledge of the character which ought principally to determine the denomination, we should prefer a name that has no determinate meaning, to one that may express a false idea. 4. In the choice of the names to be introduced, we should prefer those which have their roots in the dead languages most generally diffused, so that the word should be easily discovered by the sense, and the sense by the word. 5. The words should be carefully selected, according to the genius of the language for which they are formed."

Three orders of facts, dominated by the principle of dualism, particularly fixed the attention of the authors of the celebrated memoir of 1787, the true charta of modern chemistry. It is on *acid* compounds, *basic* compounds, and *saline* products, resulting from the combination of acids with the bases, that the labours of these hardy reformers of science bore. As to simple bodies, they preserved their old names. The four elements of organised nature, alone, lost their ancient names: vital air was called *oxygen*; inflammable air, *hydrogen*; phlogistic air, *azote*; charcoal, *carbon*. The authors of the chemical nomenclature insisted strongly on the adoption of these new names, as if they foresaw that these four elements, oxygen, hydrogen, azote, and carbon, would some day become the very sanctuary of organic chemistry. The reasons laid down by Guyton-Morveau to justify the new terms applied to the four elementary bodies of organic nature, form one of the most interesting chapters in the history of science.

He explains the name given to vital air in the following manner:—"The logic of nomenclature requires their substance to be named first, in order that the word by which we remember it should become the type of its compounds. We fulfil these conditions by adopting the expression oxygen, derived, as M. Lavoisier long since proposed, from the Greek ὀξύς, acid, and γενομαι, I beget, on account of the well-established property of this principle to convert a great number of substances, with which it combines, into acids. If we say, therefore, that vital air is oxygen gas, that oxygen unites with sulphur and phosphorus during their combustion, metals, during their calcination, &c.; the language will be perfectly clear and exact."

The reproach under which Guyton-Morveau laboured, of having considered oxygen as the generator of all the acids, is, therefore, gratuitous. Vital air received the name of oxygen because this gas, by combining with other bodies, begets a large number of acids.

(Γείνομαι is a barbarism; it is no doubt γίγνομαι he intended to say. But the verb γίνομαι itself never had the transitive signification of γεννάω, beget. In fine, the name οξυγενής signifies, literally, not the generator of acid, but acidly born, of an acid parentage, which gives an absurd meaning. It is rather ὀξυγενετης, or oxygone. οξυγονος he ought to have said.)

Hydrogen owes its ancient name of *inflammable air* to a property it possesses, of taking fire when brought into contact with a lighted body. "But this property," observes Morveau, judiciously, "does not exclusively belong to it, while it is the only body that produces water by its combination with oxygen. This is the character we thought we ought to seize upon to extract the word hydrogen, that is to say, *begetting water*."

When he created the name *azote*, Morveau was already acquainted with the experiments of Berthollet, Black and Cavendish; he knew that this gas, then called *phlogisticated air*, enters equally into the composition of ammonia and nitric acid, and he did not conceal his embarrassment to give a name to a body "which forms the radical of an acid, and assists at the same time in the production of an alkali." From which of the two compounds should he deduce the name? Must he call it nitrogen or alkaligen? These two names both offered themselves to Morveau's mind, and he finally made choice of the word azote. Here he met with the same difficulty as that which he had taken so much pains to avoid when he invented the word hydrogen. "We imagined," he observes, "that we could not do better than stop at the property of phlogistic air, which is so plainly manifested—its being unable to support animal life." In the same way, as in the case of hydrogen, Morveau would have to observe, "but this property does not exclusively belong to it." This he seems to have seen; for in proposing the word azote he hastens to add, "this gas is essentially unable to support life; it is so more truly than the acid and hepatic gases (sulphuretted hydrogen and sulphurous acid) which do not, like it, form an essential part of the atmosphere, and we have called it azote from *a*, the Greek privative, and ζοε, life."

Thus, then, according to Morveau's intention, azote signifies a *gas, not vital, and existing naturally in the atmosphere*: it is this that distinguishes it from other gases equally unrespirable, which do not form an

integral portion of the atmosphere; but are merely met with in it accidentally.

Finally, for *charcoal*, applying the term to a substance almost always mixed with foreign matters, the authors of the chemical nomenclature proposed the name *carbon*, which, since that time, has been universally applied to the definition of that body in a state of purity.

Other simple bodies, belonging, particularly, to mineral chemistry, have preserved their ancient names. Among these some are dated back to a very distant period such as gold, *aurum;* silver, *argentum;* iron, *ferrum;* copper, *cuprum;* lead, *plumbum;* tin, *stannum;* arsenic, *arsenicum;* antimony, *antimonium.* Several other names, such as cobalt, bismuth and zinc, scarcely date further back than the fifteenth or sixteenth century. Others again, as platinum, nickel, molybdenum and tungsten, bear the date of the eighteenth century.

It is important to observe that other substances formerly had names which, at the present time, have quite another meaning—thanks to the progress of chemical analysis; thus lime, magnesia, strontian, and baryta, were for a long time confounded under the common name of calcareous earth. Potash and soda only began to be distinguished from each other about the middle of the eighteenth century.

All these substances, as well as silica and alumina, were placed among simple bodies by the authors of the nomenclature; but their composition was partially seen even at that time. "Without doubt," observed Lavoisier, "these substances, which appear simple bodies to us, will one day be decomposed in their turn, and we are, probably, approaching that day, in the case of silicious earth and the fixed alkalies; but our imagination must not go beyond facts, and we have no right to declare more than nature has taught us."

These prophetic words were pronounced at a meeting of the Academy, on the 18th April, 1787. Twenty years before they were accomplished.

Bodies then reputed simple, which soon afterwards were destined to be decomposed by Davy, are divided into five classes: the first class includes "those principles which are most active in combination, such as oxygen and hydrogen, and even light and caloric, which, since the time of Boyle, were placed among the number of ponderable elements. The second class contained "the acidifiable bases;" the third class, "metals;" the fourth, "earths;" the fifth, "alkalies."

To facilitate, by means of words, the comprehension of ideas, was the problem the authors of the nomenclature proposed to resolve, and which they have perfectly resolved, in the case of mineral chemistry; for, and it is a fact we must not forget, organic chemistry was not comprised in the scientific revolution brought about by Morveau, Lavoisier, Berthollet, and Fourcroy. The services chemical nomenclature has rendered to science are inappreciable. The nomenclature was a positive conquest over time itself. In fact, without it, chemistry would not have been able to make, in three centuries, the progress it has made in fifty years.

A man may draw extremely useful lessons from the past, if his pride will allow him. Would it be believed, the nomenclature proposed by the most eminent minds, not only did not, in the first instance, obtain the approbation of the Academy, but the commissmissioners charged with the examination of the work, exhibited, so much reserve in their judgment as almost to make it equal to a condemnation. The following are a few of the passages in the report:—"This new theory," (the chemical nomenclature) "is the work of four men, justly celebrated in science, in which they have been engaged for years; but what theory ever originated with men of greater genius, by means of the most persevering and determined labour. What other ever united learned men in one opinion by the concord of the most beautiful experiments, by a mass of the most brilliant facts, than the doctrine of phlogiston? We cannot, in one day, reform and annihilate a language already spread far and wide, and familiar to all Europe, and substitute a new one for it, with etymologies either foreign to its genius, or frequently taken from an ancient language almost forgotten by learned men, and in which no trace or notion whatever can be met with of things or ideas that can give it a meaning." This report, read the 13th of June, 1787, is signed by Baumé, Cadet, d'Arcet, and Sage, and countersigned by the Marquis of Condorcet.

My readers will be gratified at my giving, at the end of this short account of the nomenclature, a table of simple bodies, with an indication of the time when each of them received the name they bear at present.

HISTORICAL TABLE OF SIMPLE BODIES.

ALUMINIUM [Aluminum].*—The Romans

* When the mode of spelling adopted by English chemists, as in this and other cases, differs from that of the author, the word is placed between brackets [ ], excepting where the termination merely depends on the difference of the language, when, of course, it must be translated.

gave the name of *alumen* to alum, and even to the metallic sulphates, (vitriol); alumine (clay) was, for the first time, chemically characterised by Margraff, in 1754.

ANTIMONY.—The name of *antimonium* is met with, for the first time, in the works of the fifteenth century. The ancients knew it under the name of *stimmi* or *stibium*.

ARSENIC [Arsenicum] (*ἀρσενικόν*).—A very ancient name, first applied to arsenious acid.

AZOTE [Nitrogen].—In 1787. Morveau.

BARYUM [Barium].—Morveau gave the name of baryta, or barota, to a body discovered by Scheele, in 1784, and described under the name of *terra ponderosa*.

BISMUTH.—This metal is noticed for the first time, under the name of *wismith*, in the writings of Paracelsus, at the commencement of the sixteenth century.

BORON.—1809. Gay-Lussac and Thénard.

BROME [Bromine] discovered and named from *βρῶμος*, a foul smell, by M. Baylard, in 1826.

CADMIUM.—1818. Hermann.

CALCIUM.—The name *calx* (lime) is very ancient, and was formerly applied to very different substances. Frederick Hoffman and J. Black first published the chemical characteristics of lime about the middle of the eighteenth century.

CARBON.—1787. Morveau. From the Latin word *carbo*, charcoal, known through every age.

CERIUM.—This word is derived from *cerita*, a mineral from whence cerium was, for the first time, extracted, in 1803, and almost at the same time by Klaproth, Hisinger, and Berzelius.

CHLORE [Chlorine].—Suspected by Glauber, and really discovered by Scheele, who called it *dephlogisticated muriatic acid*. Davy, in 1811, placed it among simple substances.

CHROME.—1797. Vauquelin.

COBALT.—The word *cobalt* had been already used by Paracelsus, but Brandt, in 1733, first obtained it in a metallic state.

COLUMBIUM.—1803. Hatchett. This body was discovered almost at the same time by Ekeberg, who called in *tantala*. It was not until 1809 that Wollaston proved the identity of columbium and tantala.

COPPER.—The name *cuprum*, from whence that of copper is derived, is first met with in in Latin authors of the fifth century.

FLUOR (radical, not isolated).—1807. Gay-Lussac and Thénard. Ampere gave it the name of Pthore from *φθόριος*, destroyer.

GLUCINIUM [Glucinum].—Glucina was discovered in 1798, by Vauquelin, in a mineral, called *terre douce*, sweet earth (*glucina*).

GOLD.—Known to the ancients. The *aurum* of the Romans; *χρυσός* of the Greeks.

HYDROGEN.—1787. Morveau.

IODE [Iodine].—Discovered and named by Courtois, in 1813.

IRIDIUM.—1803. Tennant and Descotils.

IRON.—Known in all ages. *Ferrum* of the Romans; *σίδηρος* of the Greeks.

LANTHANA.—1840. Mosander.

LEAD.—Known in every age. *Plumbum* of the Romans, *μολυβδος* of the Greeks.

LITHIUM.—Lithine was discovered in 1817, by Arfwedson.

MAGNESIUM.—The name magnesia is rather ancient. It was first applied to magnetic oxide of iron (magnes) afterwards to black oxide of manganese (black magnesia). It was only about the middle of the eighteenth century that this name was applied to the substance formerly confounded with lime, from which it was clearly distinguished by Frederick Hoffman and J. Black.

MANGANESE.—As far back as 1774, Bergmann stated, that black manganese (oxide of manganese) was the calx (oxide) of a peculiar metal, and that this metal which he called *magnesium* or *manganesium*, was, at least, as difficult to melt as platina.

MERCURY.—This name dates from the middle ages, when the alchemists gave the name of the planet Mercury to quicksilver (*argentum vivum hydrargyrum*).

MOLYBDENUM.—Scheele extracted, in the first instance, molybdic acid from a mineral called, by Cronstedt *molybdena membranacea*, from which Hielm succeeded, in 1782, in extracting metallic molybdenum.

NICKEL.—1751. Cronstedt.

OSMIUM.—1830. Tennant.

OXYGEN.—1787. Lavoisier. The name of oxygen was proposed more than ten years previously; but it was hardly before 1787 that it was generally adopted by chemists.

PALLADIUM.—1803. Wollaston. The history of the discovery of this metal presents several curious incidents, which it will not be uninteresting to notice. In the month of April, 1803, an anonymous prospectus was distributed in the streets of London, announcing the discovery of a new metal, called *palladium*, to be purchased at Mr. Foster's.

This most unusual mode of announcing to the learned world so important a discovery, appeared suspicious to a then celebrated chemist, named Cheinsvix; with the intention of exposing the imposition—of which an announcement of this kind appeared to have the character—he undertook a series of experiments which led him to believe that palladium was merely a compound of platina and mercury. A few months afterwards, the unknown author of the discovery published

a letter, in which he disputed the correctness of Chenevix's experiments. He asserted that palladium could not be produced artificially; and he offered twenty guineas to any person who would manufacture merely twenty grains, either by Chenevix's process, or by any other. In fact, the money was deposited, but no one offered himself to claim the reward. The chemists of France and Germany soon took part in these disputes. Fourcroy, Vauquelin, Rose, Richter, Tromsdorf, and Klaproth, repeated Chenevix's experiments. They unanimously declared that the new metal was not an amalgam of platina. Chenevix, nevertheless, persisted in his first opinion. At last, in 1805, two years after the appearance of the famous prospectus which had announced the discovery of the new metal, Dr. Wollaston read before the Royal Society of London, a paper in which he explained all the characteristic properties of palladium, and also the means of extracting it from crude platina. In justification of the conduct of the unknown author of the discovery, he concluded by announcing that he himself was the anonymous author. He had considered it proper to act in this manner, that he might have time to examine and explain all the phenomena, before he ventured to publish an account under his own name.

Phosphorus.—The word phosphorus (from φῶς, light, and φορος, a bearer), was first applied, by Baudouin, to phosphorescent salt (nitrate of lime), afterwards called Baudouin's phosphorus. It was some years afterwards, about 1670, that the name of phosphorus was applied to the substance, by which name it is at present known.

Platina.—1740. The word platina is the diminutive of the Spanish word *plata* (silver). The ancients appear to have known it under the name of white lead.

Potassium.—1807. Davy. The name potash (potasche) is met with for the first time only, in works published about the middle of the 18th century.

Rhodium.—1804. Wollaston.

Selenium.—1817. Berzelius.

Silicium.—Partially discovered by Lavoisier; isolated and named by Berzelius in 1809.

Silver.—Known to all antiquity. ἄργυρος of the Greeks.

Sodium.—1807. Davy. The name soda is almost contemporaneous with that of potash.

Sulphur.—Known from the highest antiquity. Θεῖον of the Greeks.

Strontium.—This name was given to it after a town in Scotland, called Strontian, where Hope and Klaproth discovered it, in 1792.

Tellurium.—1782. Müller of Reichenstein.

Thorium.—exists in combination with oxygen in thorine, from which it was extracted for the first time in 1815, by Berzelius.

Tin.—Known to the ancients. *Stannum* of the Romans. κασσιτερος of the Greeks.

Titanum.—1794. Klaproth. This substance had been previously discovered in 1791, by Grégor, who gave it the name of manakane, after the mineral manakanite.

Tungsten.—A Swedish name, which signifies heavy stone, a name given to the mineral wolfram from which Scheele extracted tungstic acid; and the brothers Elhuyart, metallic tungsten, at the end of the 18th century.

Uranium.—1789. Klaproth.

Vanadium.—1830. Sefstroem. This substance had been previously discovered, in 1801, by Del Rio, who gave it the name of erythronium; but Del Rio allowed himself to be persuaded by Descostils that erythronium was merely chrome.

Yttrium.—The oxide of yttrium was discovered in 1794, by Gedolin, in the earth, called yttria.

Zinc.—Mentioned for the first time under this name by Paracelsus, at the beginning of the 16th century.

Zirconium.—Klaproth discovered Zircona in 1789.

CHAPTER II.—AN EXPOSITION OF THE PRINCIPLES OF NOMENCLATURE.

Nomenclature is a language of abbreviation, applied to names of compound bodies. These compound bodies are *acids*, *bases*, and *neutral* or *saline* substances. Nomenclature, therefore, implies a classification: it possesses a philosophical value, and at the same time facilitates the study of science.

The names of simple bodies do not, properly speaking, constitute a chemical nomenclature, any more than the names of plants and animals constitute a botanical or zoological nomenclature. It is, therefore, incorrect to say, nomenclature, instead of names, or denominations, when speaking of simple bodies. The intention of a nomenclature is, not merely to indicate the names of things, but also to attach to these names ideas of classification of a more general nature. Thus a name terminating in *ic*, not only gives a particular idea of the compound to which it is applied, but also shows that this compound possesses general properties, which it partakes of along with all those bodies that belong to the same group. It is the same in the cases of names terminating in *ate*, *uret*, &c.

Before we explain the principles of nomenclature, it is indispensable, in the first instance, to define the three orders of compound bodies; for, to repeat the observation, nomenclature in this instance implies a classification; the one is inseparable from the other.

1. Acids.—We generally understand by acids, compound bodies which possess a sharp or astringent taste, and redden the blue tincture of turnsol. But these characters have not an exclusive value; they are wanting in all acids that are insoluble in water, such as silicic and boric acids. An acid is a substance which can combine with another body, which performs the part of a base. Such is the most simple, and at the same time the most general definition that can be given of an acid. If we submit the result of this combination (*salt*) to the action of the galvanic pile, the acid is carried to the electro-positive pole, and the base to the electro-negative.

2. Bases.—We designate, by the term base, all compound bodies which possess the property of combining with an acid, to form a substance we have agreed to call a *salt*. In this combination the properties of the base, as well as those of the acid, are equally obliterated. They have disappeared, or, to employ the technical term, they are neutralised. Submitted to the action of the pile, the product of this combination is decomposed: the base appears at the electro-negative pole, and the acid at the electro-positive.

3. Neutral or Saline Compounds.—This class, the most numerous of all, comprehends those compound bodies that present neither the characteristics of the acids or of the base. At the head of this series of bodies are found those salts which are called neutral. All salts produced by the combination of an acid with a base are not neutral; in other words, the properties of one of the constituent parts are not completely neutralised. Sometimes it may be the acid that predominates; at other times, the base. From thence arises three orders of salts:—1. *Neutral salts properly, so called.* 2. *Acid salts.* 3. *Basic salts.* All other compound bodies, which are neither acid nor saline, are called *neutral* or *indifferent*.

Such was the first chemical classification, even before the time of Lavoisier. It facilitated, or enforced to a certain extent, the total reformation of the ancient nomenclature.

Two simple bodies combine with each other, producing a compound body. According to the established classification, this body is either an acid, a base, or an indifferent compound. But cannot we specify the nature of this compound by its simple denomination without finding it necessary to recur to chemical means? In this lies the whole secret of nomenclature. In fact, a slight modification in the termination of the name of one of the elements of the compound, at once shows whether it is acid, basic, or neutral. This is the reason why the terminations *ic*, *ate* and *uret* explain as much as long periphrasis.

Combination supposes a molecular union of two or more elementary substances—a union, the result of which is a compound body. This union is so intimate that it is impossible to recognise, by the mere sight of the compound, the nature of its elements. The elements lose, by combination, all their ordinary characteristic properties. Thus the compound of oxygen and carbon, which we call carbonic acid, has none of the properties, either of oxygen or carbon. It is perfectly distinct from what we call a mixture. In a mixture we easily recognise the substances by which it is formed; generally, a purely mechanical operation will be sufficient to separate them. When several bodies are mixed together no sensible physical phenomenon takes place. There is neither the production of heat nor light. The sum of the substances mixed represents the volume of the mixture. There is no condensation—such as generally occurs in the case of combination. In a mixture the molecules are visible to the naked eye, or with the assistance of the microscope; and it has been agreed to call these, *integrant* molecules, (*homogeneous* molecules), which are united to each other by the power of cohesion. In a combination, the molecules (atoms) are physically inappreciable: their presence can only be proved by chemical means. These molecules, called *constituents* (heterogens), are united with each other by means of affinity.

Terminations indicating compound *free acids* of two degrees of oxygenation:—

1st degree—*ic*, (containing the largest amount of oxygen).

2nd degree—*ous*, (containing the smallest amount of oxygen).

Lavoisier observed, "acids are compounds of two substances belonging to the order of those we look upon as simple substances. One in which its acidity consists, is the substance from which the name of the class or genus ought to be borrowed; the other, is proper to each acid, and distinguishes some from others; and it is from this substance the specific name ought to be borrowed; but in the case of most acids, the two constituent principles, the acidifying and acidified principle, may exist in different

proportions, constituting all the various variations of equilibrium or saturation. This is what we observe in the case of *sulphuric acid* and *sulphurous acids*. We have expressed these two states of the same acid by varying the termination after the specific name."

The acidifying principle is oxygen. Oxygen gave the name of the genus, and the element with which it is combined, that of the species—there would be nothing to desire here if Lavoisier had not, in this case, made oxygen perform too exclusive a part. Independent of oxygen, there are other substances, such as sulphur, chlorine, iodine, bromine, &c., which form so many different genera of acids, into which no oxygen enters. If Lavoisier had not given an exaggerated importance to oxygen, the nomenclature (of mineral chemistry) would have been perfect. Every later discovery would have arranged itself as if in its natural position. However acute the genius of man may be, the future must be hidden from him; and if he has the audacity to go beyond the limits of the present, he exposes himself to the risk of being proved to be in error by the experience of later days.

As oxygen was supposed to exist in all acids, its name might have been omitted, without inconvenience. (Guyton-Morveau did not appear entirely to partake of the opinion of Lavoisier with respect to oxygen, when considered as the principle of all acids).

Examples:—

Carbonic acid,
Silicic acid,

instead of saying—

An acid compound of oxygen,
An acid compound of oxygen and silica.

Thus, therefore, according to Lavoisier's doctrine, there was but a single genus of acids, *oxacids*. But science did not remain stationary. It was discovered that other bodies could perfectly replace oxygen in its combinations. Thus instead of saying—

Carbonic acid,
Silicic acid,

we ought to say—

Oxycarbonic acid,
Oxysilicic acid:

preserving the generic name *oxy*, an abbreviation of oxygen; from this, we are obliged to say—

Sulphochloric acid,
Chloroboric acid,
Fluoboric acid,
Hydrobromic acid,
Hydroselenic acid, &c.

This slight correction, not only gives a more exact idea of things, but it also has the advantage of assimilating chemical nomenclature with the natural sciences. Here, in fact, the name of the genus is designated by the initial letter, followed by the name of the species, the names P. somniferum, P. rheas, P. Orientalis, &c., at once point out, by the initial P. (Papaver), that these species of plants belong to the poppy genus, distinguished from all other genera of vegetables by peculiar characters.

When oxygen is capable of combining itself in two different proportions with the same quantity of another body, and when the resulting substances are acids, we give the termination *ous* to that which contains the smallest proportion of oxygen, while the most oxygenated substances are terminated in *ic*.

"Here," observes Lavoisier, "the principle of our method of nomenclature appears to be at fault, and it would appear difficult to extract from the acidifiable base, two denominations which should express, without circumlocution and periphrasis, the two degrees of saturation; reflection, however, and more powerfully, perhaps, necessity, have opened to us new resources, and we have thought we might allow ourselves to express the variety of acids by a simple variation in the termination."

Examples:—

Arsenious acid,
Arsenic acid.

There is a smaller proportion of acid in arsenious acid than in arsenic acid.

(These two degrees of acidification oblige us to say a word on multiple proportions, a law, which Lavoisier had already nearly discovered, but which was only clearly formulated by Dalton.)

(Certain elementary bodies are capable of combining in various proportions; thus chlorine combines with mercury in two different proportions. In the first of these compounds, there is a constant amount (1 equivalent) of chlorine, combined with one determined amount (1 equivalent) of mercury: this is calomel. In the other there is double the amount of chlorine (2 equivalents) combined with the same quantity of mercury (1 equivalent): this is corrosive sublimate. In the same manner, 14 parts of nitrogen combine with 8, 16, 24, 32, and 40 parts of oxygen to produce five different compound bodies. We see by these examples that the numbers that express the different proportions of an element which enter into a given compound, are the multiples of a number, taken as unity. These proportions are usually to each other as the numbers 1, 1½, 2, 3, &c., or as 2, 3, 4, 6. This is what we call the law of multiple proportions.)

At a later day it was proved analytically,

that certain bodies, and particularly oxygen, could combine, not merely in 2, but in 3 or 4 different proportions and produce acid compounds. The primitive nomenclature, being too restrictive, needed enlargement. Under the impossibility of modifying the already modified terminations, an idea arose of placing, before the name of the acid containing a smaller quantity of oxygen than the acid terminated in *ous*, the Greek preposition *hypo* (ὑπό below), preserving the termination *ic*. Again, the acid containing less oxygen than the last, received the preposition *hypo*, and preserving the termination *ous*.

The first modification was introduced into the nomenclature at the time Gay-Lussac discovered two new acids of sulphur containing less oxygen than sulphurous acid, according to this modification we have

Sulphuric acid	SO^3	ancient
Sulphurous acid ..	SO^2	names.
Hyposulphuric acid	S^2O^5	new
Hyposulphurous acid	S^2O^2	names.

Phosphorus, nitrogen, chlorine, &c., can, in the same manner as sulphur, form acids less oxygenated than the acid terminating in *ous*.

In a series of compound acids, that containing most oxygen is sometimes preceded by the particle *per* or *hyper*. Examples: perchloric acid, permanganic acid. The word *hepta* placed before the name of an acid signifies that the acid contains 7 equivalents of oxygen. Example: heptachloric acid.

The partisans of dualism, that is to say of the classification of simple bodies according to their electrical nature, have established it as a principle, that in the nomenclature of compound bodies, it is proper to place the name of the electro-negative, first, (the generic name) and the name of the electro-positive body last (the specific name.) On this account we ought to say chlorohydric and not hydrochloric; as we should say oxysulphuric acid, if it had not been agreed upon to say shortly sulphuric. It is the same in the case of iodhydric, bromhydric, fluohydric, sulphohydric, &c., in which iodine, bromine, fluor, and sulphur are, when looked upon according to the views of the electrochemical theory, analogous to oxygen in sulphuric, carbonic, phosphoric acid, &c.

Regarded in this light, the name hydro-acids applied to the chlorohydric, iodhydric, bromhydric acids, &c., is inadmissible. To the oxacids we must oppose the chloracids, the iodacids, the bromacids, the sulphacids, &c., the more particularly because chlorine, bromine, iodine, and sulphur, each of them, perform the same part as oxygen, and, by combining with other simple bodies, produce acid, as well as basic compounds.

Basic Compounds.—All metallic substances, during their calcination, increase in weight in proportion to the oxygen they absorb, at the same time they lose their metallic lustre, and are reduced into an earthy powder. The ancients gave the name of calx not only to metals brought into this state, but also to every substance which had been exposed to the action of fire for a length of time without melting. We have abolished the expression metallic calx, and substituted that of oxide, from the Greek *οξυς*. These are the master's (Lavoisier) words. Here again the laws of multiple proportions necessarily bring several necessary modifications into the nomenclature. As in the case of acids, it was found that oxygen would sometimes unite with the same metal in different proportions. When this is the case the compound that contains the least (first) proportion of oxygen, is called protoxide, from *πρῶτος*, first. A compound that contains twice the quantity, deutoxide, from *δεύτερος*, or, employing a Latin word, bioxide or binoxide. The third degree of oxidation is called tri-oxide or tritoxide from *τριτός*, third. Finally, the fourth degree of oxidation is called quadroxide. This last oxide is seldom met with. The generic denomination of the oxide is followed by the specific denomination of the metal.

Examples:—

Protoxide of lead.
Binoxide of lead.
Protoxide of copper.
Binoxide of copper.

The oxide containing once and a half as much oxygen as the protoxide, is called sesquioxide.

Examples:—

Protoxide of iron.
Sesquioxide of iron.

When a metal only exhibits two degrees of oxidation, the first preserves the name of protoxide, and the last, which offers the *maximum* of oxidation, is called peroxide—thus we say, indifferently, sesquioxide of iron or peroxide of iron.

We call those oxides which possess less oxygen than the protoxides and suboxides, but since it has been discovered that this pretended suboxides are only mixtures of protoxide and the metal, the denomination suboxide will not be long before it disappears from the nomenclature.

The protoxides are generally bases—that is, compounds which, by uniting to acids, form salts; they are basic oxides or oxi-bases. The peroxides, on the contrary, most frequently possess the properties of acids. Thus, the peroxides of tin, antimony, iron,

manganese, &c., are true acids (metallic acids). They are called stannic, antimonic, antimonious, ferric, manganic acid, &c.

By a fundamental law, the more the proportion of oxygen increases in a basic oxide, the more the latter loses its character of a base, and has a tendency to become acid, so that the most oxygenated compounds are acid, while the least oxygenated are basic.

(To be continued.)

ON THE CHEMICAL CONSTITUTION OF PHILIPSITE OR LIME HARMOTOME.*

BY ARTHUR CONNELL, ESQ.

THE late researches of Köhler appear to be sufficient to show that the constitution of the barytic and lime harmotome cannot be expressed by the same chemical formula, on substituting lime for barytes. This conclusion follows principally from his analysis of the barytic species, because that examination shows a complete conformity in the results of the analysis of that species from three different localities; whereas, the previous analysis differed materially from one another; my own of the barytic harmatome of strontian, being the only one in nearly perfect accordance with Köhler's result. We may, therefore, probably take the formula proposed by Köhler—

$$2\,(B\,So)\,S^4 + 7\,A\,S^2 + 12\,H\,O,$$

as representing the constitution of the barytic mineral.

The exact constitution of the lime species is, however, not so clear. The analysis of the lime harmotome of Marburg and Kassel, given by Köhler, differ considerably from those published by Gmelin and Hepel, of this mineral, from the former of those localities; the oxygen of the one-atomic bases, according to the first of these chemists, being 2·56, and, according to the others, in one instance, 2·88, and in another, 3·13—differences which, as the amount of the other constituents is much the same in all the cases, render it scarcely possible to represent all the results by the same formula. It therefore appears to me that this part of the subject affords room for further investigation; and as a contribution to that end, an analysis of the philipsite or lime-harmotome of the Giant's Causeway will, perhaps, not be unacceptable.

The specimen examined was in well-sized white and translucent twin crystals of the ordinary harmotome form. Their sp. gr. was found to be 2·17, at 61°.

A portion of the crystals lost by ignition 16·96 per cent. of water.

20 grains in fine powder were treated with strong muriatic acid, when immediate gelatinisation took place; and, by the usual analysis, there were obtained—

Silica	9·47
Alumina	4·36
Lime	0·97
Potash	1·11
Soda	0·74
	16·65

Or in 100 parts—

				Oxygen.	
Silica	47·35			24·83	8
Alumina	21·80			10·18	3
Lime	4·85	1·36	}	3·24	1
Potash	5·55	0·94			
Soda	3·7	0·94			
Water	16·96			15·07	4½
	100·21				

This would give the formula $2(CSoN)\,S^2 + 6AS^2 + 9\,HO$.

These results differ materially in regard to the amount of the one-atomed bases from those of Köhler, and approach more nearly to those of Gmelin and Hepel, particularly to one of their results; the proportion of the oxygen, in which instance, will admit of being expressed by the above numbers, almost as well as by any others, or at least will thus yield the most admissible formula. These chemists found in the case alluded to—

				Oxygen.
Silica	48·02			25·03
Alumina	22·60			10·3
Lime	6·56	1·84	}	3·13
Potash	7·50	1·27		
Protoxide of iron	0·18	0·02		
Water	16·75			14·88
	100·61			

Considering, however, that the other of philipsite, by Khöler and Gmelin, and Hepel, can hardly be brought within this formula, I should by no means be inclined to give it as one which may be adopted with perfect certainty.

The presence of soda which has not been previously observed in this mineral, was clearly ascertained, as it also was in the previous instance of the barytic harmotome of strontian, although in much less quantity. Indeed, I have reason to believe, that the presence of a portion of this alkali in minerals, usually regarded as containing potash only, is much more frequent than is commonly supposed.

If we assume what it would seem, can now hardly be doubted, that there is an es-

* *Edinburgh Philosophical Journal.* N.S., VOL. IV.

sential atomic difference in the chemical constitution of the two spars, we shall, of course, be prepared to expect that the measurement of the angles will also present differences, although the general form of the crystals may be similar in the two cases; and the ordinary opinion of crystallographers appears to be in favour of the existence of such differences.

ON THE COMPOSITION OF THE FIRE-DAMP OF THE NEWCASTLE COAL MINES.*

BY THOMAS GRAHAM, ESQ., F.R.S.

SOME years ago I examined the gas of these mines, with the same result as Dr. Henry, Davy, and Dr. Turner had previously obtained, namely, that it contains no other combustible ingredient than light carburetted hydrogen. But the analysis of the gas of the coal-mines in Germany, subsequently published, showing the presence of other gases, particularly of olefiant gas, has rendered a new examination of the gas of the English mines desirable. The gases were—1. From a seam named the Five-Quarter seam, in the Gateshead colliery, where the gas is collected as it issues, and used for lighting the mine. 2. The gas of Hebburn colliery, which issues from a bore let down into the Bensham seam,—a seam of coal which is highly charged with gas, and has been the cause of many accidents. 3. Gas from Killingworth colliery, in the neighbourhood of Jarrow, where the last great explosion occurred. This last gas issues from a fissure in a stratum of sandstone, and has been kept uninterruptedly burning, as the means of lighting the horse-road in the mine, for upwards of ten years, without any sensible diminution in its quantity. The gases were collected personally, by my friend Mr. J. Hutchinson, with every requisite precaution to ensure their purity, and prevent admixture of atmospheric air.

The usual eudiometrical process of firing the gases with oxygen was sufficient to prove that they all consisted of light carburetted hydrogen, with the exception of a few per cent. The results were as follows:—

GATESHEAD GAS.

Specific gravity, 0·5902.

Carburetted hydrogen	94·2
Nitrogen	4·5
Oxygen.....	1·3
	100·0

The density of such a mixture is, by calculation, 0·5813.

KILLINGWORTH GAS.

Specific gravity, 0·6306.

Carburetted hydrogen	82·5
Nitrogen	16·5
Oxygen.....	1·0
	100·0

The theoretical density of this gas, deduced from its composition, is 0·6308.

The Hebburn gas was of specific gravity 0·6327.

Seventy-nine measures of the Killingworth gas, mixed with an equal volume of chlorine, left in the dark for eighteen hours, and afterwards washed with alkali, were reduced to 75 measures; from which the presence of 4 measures of olefiant gas might be inferred. But in a comparative experiment made at the same time on 25·3 measures of pure gas of the acetates, mixed with an equal volume of chlorine, a contraction occurred of 1·3 measure; that is, in exactly the same proportion as with the fire-damp.

It was observed that phosphorus remains strongly luminous in these gases, mixed with a little air, while the addition to them of one-four-hundredth part of olefiant gas, or even a smaller proportion of the volatile hydrocarbon vapours, destroyed this property. Olefiant gas itself, and all the allied hydrocarbons, were thus excluded

Another property of pure light carburetted hydrogen, observed by myself, enabled me to exclude other combustible gases; namely, that the former gas is capable of entirely resisting the oxidating action of platinum black, and yet permits other gases to be oxidated, which are mixed with it, even in the smallest proportion, such as carbonic oxide and hydrogen,—the first slowly, and the last very rapidly; air or oxygen gas being, of course, also present in the mixture. Now, platinum black had not the smallest action on a mixture of the gas from the mines with air. No moisture appeared, or sensible contraction, and no trace of carbonic acid could be discovered after a protracted contact of twenty-four hours; while, with the addition of one per cent. of hydrogen, the first effects were conspicuously evident in three minutes, and with the same proportion of carbonic oxide, the gas became capable of affecting lime-water in half an hour. These experiments were repeated upon each of the three specimens of fire-damp.

Potassium fused in the fire-damp did not become covered with the green fusible compound of carbonic oxide, nor occasion any contraction. Indeed, however carefully the

* *Philosophical Journal.*

heat was applied to the potassium, by means of an oil-bath, a slight permanent expansion always ensued. The same thing occurred in pure gas of the acetates. It appeared that potassium could not be heated above 300° F. in pure carburetted hydrogen, without causing a decomposition and the evolution of free hydrogen gas.

The gas was also inodorous, and clearly contained no appreciable quantity of any other combustible gas than light carburetted hydrogen. The only additional matters present were nitrogen and oxygen; the specimen collected in the most favourable circumstances for the exclusion of atmospheric air, namely, that from the Bensham seam, still containing 0·6 per cent. of oxygen. The gases also contained no carbonic acid.

It is worthy of observation, that nothing oxidable at the temperature of the air is found in a volatile state associated with the perfect coal of the Newcastle beds. The remarkable absence of oxidability in light carburetted hydrogen appears to have preserved that alone of all the combustible gases originally evolved in the formation of coal, and which are still found accompanying the imperfect lignite coal of Germany, of which the gas has been examined. This fact is of geological interest, as it proves that an almost indefinitely protracted oxidating action of the air must be taken into account in the formation of coal; air finding a gradual access through the thickest beds of superimposed strata, whether these strata be in a dry state or humid.

In regard to measures for preventing the explosion of the gas in coal mines, and of mitigating the effects of such accidents, I confine myself to two suggestions. The first has reference to the length of time which the fire-damp, from its lightness, continues near the roof, without mixing uniformly with the air circulating through the workings. It was found that a glass jar, of six inches in length and one inch in diameter, filled with fire-damp, and left open with its mouth downwards, continued to retain an explosive mixture for twenty minutes. Now it is very desirable that the fire-damp should be mingled as soon as possible with the whole circulating stream of air, as beyond a certain degree of dilution it ceases to be explosive. Mr. Buddle has stated, "that immediately to the leeward of a blower, though for a considerable way the current may be highly explosive, it often happens that after it has travelled a greater distance in the air-course, it becomes perfectly blended and mixed with air, so that we can go into it with candles; hence, before we had the use of the Davy lamp, we intentionally made 'long runs,' for the purpose of mixing the air." It is recommended that means be taken to promote an early intermixture of the fire-damp and air; the smallest force is sufficient for this purpose; as a downward velocity of a few inches in the second will bring the light gas from the roof to the floor. The circulating stream might be agitated most easily by a light portable wheel, with vanes, turned by a boy, and so placed as to impel the air in the direction of the ventilation, and not to impede the draft. The gas at the roof undoubtedly often acts as an explosive train, conveying the combustion to a great distance through the mine, while its continuity would be broken by such mixing, and an explosion, when it occurred, be confined within narrower limits.

Secondly, no effective means exist for succouring the miners after the occurrence of an explosion, although a large proportion of the deaths is not occasioned by fire, or injuries from the force of the explosion, but from suffocation by the after-damp, or carbonic acid gas, which diffuses itself afterwards through all parts of the mine. It is suggested that a cast-iron pipe, from eight to twelve inches in diameter, be permanently fixed in every shaft, with blowing apparatus, above, by which the air could be thrown down, and the shaft itself immediately ventilated after the occurrence of an explosion. It is also desirable that, by means of fixed or flexible tubes, this auxiliary circulation should be further extended, and carried as far as practicable into the workings.

ON A NEW PROCESS FOR OBTAINING PURE CHLORINE GAS.*

BY PROFESSORS R. E. AND W. B. ROGERS.

This process is founded on the powerful oxidating action of chromic acid, especially when liberated in a solution, and consists in causing a reaction between hydrochloric acid and this substance, in which the chlorine of the former is set free. Our mode of proceeding is as follows:—

To 1 part of powdered bichromate of potash, in a small retort or flask, we add 6 parts of hydrochloric acid, of spec. grav. about 1·16, and apply a gentle lamp heat for a few seconds, so as to bring about a brisk reaction. The chlorine is now rapidly evolved, and continues to be disengaged as fast as is convenient without requiring any further application of the lamp.

Referring to the composition of the bichromate of potash and of hydrochloric acid, it will be seen that 1 equivalent of bichromate

* *Silliman's Journal.*

of potash and 7 of hydrochloric acid, are capable of evolving 3 equivalents of chlorine, at the same time giving rise to 1 equivalent of the sesquichloride of chromium, 1 of the chloride of potassium, and 7 of water.

In order to ascertain how near we might approach to the equivalent quantity of chlorine above deduced, we resort to the following method:—Knowing that a strong solution of chloride of sodium is much less absorbent of the gas than ordinary water, we prepared a quantity of saturated brine, through which we passed chlorine until the liquid appeared to be fully charged. With this we filled a tall graduated vessel, designed to receive the gas, and a porcelian bowl, which served as a pneumatic trough, and having placed 4 grms. of the bichromate with an excess of hydrochloric acid in a small retort, we passed the gas as it was evolved through the chlorous saline solution into the narrow graduated jar. After urging the process until the action entirely ceased and no further gas escaped, we measured the resulting gas with the usual precautions at 60°. Its volume was found to be 54·5 cubic inches. On repeating the experiment with the same amount of bichromate and acid, and with the same brine, we obtained in the second trial 55·5 cubic inches, and in the third 56·2 cubic inches of the gas, the increase being evidently due to the diminished absorption arising from the more complete saturation of the liquid with chlorine.

Taking 76·5 grms. as the weight of 100 cubic inches of chlorine at 60° F., the volume due to the entire decomposition of 4 grms. of bichromate of potash is 57·3 cubic inches. It thus appears that, with proper precaution, this process may be made to yield $\frac{54}{57}$ths, or nearly the whole theoretical amount of the gas.

ON THE BIBASIC ARSENIATE OF AMMONIA AND MAGNESIA, CORRESPONDING TO THE BIBASIC PHOSPHATE OF THE SAME BASES, WITH REMARKS ON ITS APPLICATION.*

BY M. LEVOL.

NOTWITHSTANDING the striking analogy which the arsenical compounds exhibit with those of phosphorus, it does not appear that the existence of an arsenical combination, corresponding to the most important of the double ammonia-phosphates of magnesia, has hitherto been sought for; I allude to that which is met with among certain products of the animal organism, and is so frequently employed in chemical analysis, on account of its insolubility, for the quantitative determination of phosphoric acid.

With these considerations I thought it would be interesting to ascertain whether it might be possible to produce with arsenic acid the analogue of the phosphate above mentioned, to employ it, should it partake of its insolubility, for the estimation of arsenic acid. Such a salt does indeed exist: it is similar in every respect to the bibasic phosphate of the same bases and its formula resembles that assigned by Berzelius to the phosphate*, viz. $2\,N\,H^3, 2\,Mg\,O, As\,O^5 + 10HO$.

This salt is obtained in the same way as the corresponding phosphate, *i.e.* by adding a soluble ammonio-magnesian salt to the liquid containing the arsenic acid, after having previously rendered it ammoniacal; like the phosphate it does not make its appearance immediately, but only after some minutes, unless agitated; it is also deposited, in the form of very minute crystals, on the sides of the vessel, and its insolubility may likewise be compared to that of the phosphate. 1 part of arsenic acid, diluted with 56818 parts of water rendered ammoniacal, was made apparent shortly after the addition of a few drops of a concentrated solution of ammonio-sulphate of magnesia. I think it would be difficult to enumerate two salts more accurately comparable one with the other than the phosphate and arseniate in question.

I employed this new salt in a very difficult case of analysis, the quantitative separation of the arsenic and arsenious acids, the latter not yielding an insoluble double salt with ammonia and magnesia. The precipitate after collection is dried and heated to redness, taking care to avoid any reducing influence; there remains $2\,MgO, AsO^5$ = 55·74 per cent. of the new salt, which represent 41·02 per cent. arsenic acid.

It is likewise very probable that, from the extreme insolubility of the compound which the double ammonio-magnesian salts are capable of forming with arsenic acid, they might be very useful as an antidote in cases of poisoning with this acid; and it is highly desirable that those physicians who have occasion should try the sulphate, nitrate, or muriate of ammonia and magnesia, as an antidote for arsenic acid.

* *Comptes Rendus*, July 6, 1846.

* The water contains five times as much oxygen as the magnesia, and the ammonia is just sufficient to form a neutral salt with the phosphoric acid of the magnesian salt (Berzelius).

ON A NEW METHOD OF DISTINGUISHING BARYTA FROM STRONTIA BY THE BLOWPIPE.*

BY EDWARD J. CHAPMAN.

It is well known that baryta, strontia, and their respective salts, yield with most reagents very similar results. The property which they possess of forming with diluted sulphuric acid a precipitate which dissolves entirely before the blowpipe in a bead of carbonate of soda, serves to distinguish them from all other bodies. It is desirable, therefore, to be able to ascertain, by some simple process, of which sulphate the precipitate consists (presuming only one to be present), especially in cases where it may not be convenient to dilute the solution.

I have found the following method of distinguishing the two compounds to succeed perfectly:—A little carbonate of soda must be fused before a blowpipe in a loop of platinum wire, moistened with a drop of a dilute solution of any manganese salt, and exposed to an oxidating flame, until, on cooling, the bead assume a greenish-blue colour. If, then, a portion of the compound under examination be fused into this, also before an oxidating flame, until the globule be almost saturated, it will either become, on cooling, of a light blue colour, approaching to that which it possessed before the addition of the compound, or it will change to a brown, dark gray, or greenish-brown colour. In the former case, the precipitate will be composed of sulphate of baryta; in the latter, of sulphate of strontia.

Should the fused mass, after the addition of the precipitate, not give a very decided result, a little more of the manganese solution must be added, and the globule again exposed fot a few seconds to an oxidating flame, when, on cooling, one of the above reactions will be developed.

The hydrate, and all the soluble salts of baryta, become green or blue when heated, *per se*, before the blowpipe with a drop of a dilute manganese solution. Salts of strontia, treated in a similar manner, become, on cooling, grayish-black or brown, sometimes with a slight tinge of green.

If the precipitate produced by sulphuric acid consists of the mixed sulphates of baryta and strontia, it will render the blue colour of the soda and manganese bead brown, gray, or brown mixed with grayish-green.

In this case, the following simple method of detecting the presence of baryta may be resorted to by the blowpipe analyst:—The precipitate is to be fused in a small platinum spoon with three or four parts of chloride of calcium, and the fused mass digested in a little boiling water. A portion of the clear supernatant liquid, decanted into a test-tube, and diluted with ten or twelve parts of pure water, is then to be tested with a few drops of a solution of chromate of potash. If baryta be present, a muddiness or precipitate will immediately be occasioned. It is perhaps needless to observe, that chromate of potash causes a precipitate only in concentrated strontia solutions, and produces no reaction in solutions of lime salts.

* *Chemical Gazette.*

ON A NEW METHOD OF ESTIMATING LEAD.*

BY FLORES DOMONTÉ.

After several experiments with a view to discover a ready method for the estimation of lead, I have stopped at the following, which is simple, quick, and accurate. It suffices, in fact, to dissolve the lead in an acid, to treat this solution with an excess of potash, and to precipitate the metal in a state of sulphuret by a solution of sulphuret of sodium of known strength. As will be seen, this process is analagous to that of M. Pélouze for the estimation of copper by precipitation with sulphuret of sodium from its ammoniacal solution.

PREPARATION OF THE NORMAL SOLUTION OF SULPHURET OF SODIUM.

M. Pélouze prepares his normal solution by dissolving the sulphuret of sodium in such a quantity of water, that about 30 cub. centim. of the liquid precipitate 1 grm. of metal.

I employ the same reagent, but weaken the solution; for the equivalent of lead being higher than that of copper, less sulphuret is required to precipitate 1 grm. of the first metal than for 1 grm. of the second. These quantities are in the inverse ratio of their equivalents, *i.e.* 1—3·2. To 1 vol. of M. Pélouze's solution I add 3 vols. of water, which is very nearly in the proportions indicated. I thus obtain for assays of lead a liquid corresponding to that employed for copper, and have the advantage of using but one test-liquor for the two metals.

To graduate the sulphuret of sodium, I make an assay with pure metal; I weigh off 1 grm. of lead, which I place in a flask capabable of holding from 150 to 200 cub. centim.; I add 7 to 8 grms. of commercial nitric acid, and apply a gentle heat; I dilute

* *Comptes Rendus*, May 18, 1846, and *Chem. Gaz.*

with a little water, when the metal is entirely dissolved, and treat the liquid with a solution of caustic potash, which displaces and redissolves the oxide of lead. The liquid is maintained at a temperature near to ebullition, and the test-liquor, which has been previously placed in a burette, gradually added. Each addition of liquid necessarily produces a black precipitate of sulphuret of lead; from time to time the liquid is boiled, when it brightens, and I observe carefully the precise point at which a drop of the reagent produces no further precipitate. I now read on my graduated tube how much liquid has been employed, say 40 cub. centim. This number will have in all assays the value of 1 grm.; as many hundreds of this number as have been employed, so many hundredths of a gramme of lead will the substance submitted to analysis contain. With a little practice the whole operation may be completed in 20 minutes, and the amount of lead ascertained to within 1 per cent. This is the widest limit of error, for frequently it has proved accurate to within a few thousandths.

APPLICATIONS OF THE PROCESS.

It is very seldom that the lead to be examined is in a state of purity; it is almost always accompanied with foreign metals, such as tin, antimony, arsenic, iron, copper, &c. Among commercial products, white lead and the pyrolignite of lead are the only ones, as far as I am aware, in which lead is the sole metal present. I shall now describe the peculiar precautions to be taken in these different assays. Tin, antimony and arsenic in no way interfere with the process, for these metals are not precipitated by sulphuret of sodium when a large excess of alkali is present. The insoluble oxides of tin and antimony might be separated by filtration, and also the arsenious acid, which is wholly retained by the stannic acid, as proved by the recent experiments of M. Levol. But this precaution is quite unnecessary; it is more simple to make the assay without filtering. With respect to iron, nickel and cobalt, they are not commonly met with associated with lead; nevertheless, I ascertained that they do not in the least interfere with the success of the experiment. The same is the case with zinc (which is precipitated after the lead, as M. Pélouze has shown, but the sulphuret of which is white, while that of the lead is black). The presence of zinc is rather an advantage, for this change of colour of the precipitate is perhaps more readily perceived than the non-precipitation.

When copper occurs with lead the process is not less applicable, but it is somewhat more complicated. In a first experiment I determine the copper by M. Pélouze's method. I then make a synthetic assay on a mixture formed of a weight of copper equal to that which I found by experiment, and 1 grm. of lead. This assay shows by how many divisions my plumbimetric liquor ought to be diminished on examining the alloy. In fact, this number will be the difference between the results of the assay of pure lead (1 grm.) and those of the assay of 1 grm. of lead to which copper had been added. This being done I examine my alloy in the ordinary way.

Let us suppose that an alloy, in which analysis indicates 10 per cent. of copper, is under examination. To make the assay of such an alloy a synthetic operation is made with 1 grm. of lead and 1 decigrm. of copper; the ordinary operation is then made on 1 grm. of the alloy; synthesis will have shown how many divisions of the burette 1 decigrm. of copper requires; this number subtracted from the total number obtained by my operation, and which represents the sum of the two metals, will give as difference the number of divisions employed in the precipitation of the lead, and consequently the quantity of lead.

I will observe that the operation is most accurate when the copper forms at least one-tenth of the alloy. It will always be easy, knowing the quantity of copper, to add sufficient pure metal to make it one-tenth.

Bismuth, I confess, cannot be separated from lead by this method; but the same applies to nearly all analytical processes. The inconvenience is quite inconsiderable with respect to its application to the arts; in fact, the price of bismuth is a guarantee, commercially speaking, that this metal will not occur with lead; nevertheless I intend to continue my experiments, and I hope to arrive at an easy method of separating these two metals.

The examination of white leads and acetates of lead is extremely simple; it does not differ from those of pure lead, and needs no further direction. I will only state, that the application of my process to the analysis of these two commercial products will, in my opinion, be of some importance, for no substance is more adulterated.

The new method may also be applied to the examination of sulphate of lead; but it is not of much importance, for generally the native sulphuret of lead is examined both as to the lead and the silver it contains, and my method merely points out the quantity of lead.

A TABLE OF URINARY DEPOSITS, WITH THEIR CHARACTERISTICS AND TESTS.*

BY W. PROCTER, ESQ.

I. COLOURED.

(A.) *Crystalline*, which is *uric acid*, characterised by having the rhombic form, or that of square tables; soluble in nitric acid by heat in effervescence, which, on evaporation, leaves a beautiful pink deposit (murexid of Liebig,) becoming purple on the addition of ammonia; soluble in a boiling solution of potassa, from which hydrochloric acid precipitates it as a white gelatinous substance, speedily becoming crystalline.

Before the blowpipe it blackens and dissipates with a peculiar animal odour.

(B.) *Amorphous*, which may be—

1. *Pink, red, or yellow urate of ammonia*, is soluble in hot water, and again deposited on cooling; soluble in boiling solution of carbonate of potassa; boiled with solution of potassa, evolves ammonia; has all the characters of uric acid with nitric acid.

Before the blowpipe comports itself as uric acid, except that it gives out ammonia, and decrepitates strongly.

2. *Red or brown blood.*—Urine becomes opaque by heat or nitric acid. Microscope detects the blood-discs, which often subside, and form a distinct layer at the bottom of the vessel; chloride of sodium, and other neutral salts, heighten the colour.

3. *Green or brown bile.*—If, from the brown colouring matter (biliphocin), on addition of nitric acid, the urine becomes blue, then green, afterwards violet and red, and lastly assumes a yellow or yellowish-brown colour; if in small quantity, the intermediate colours are not observed: hydrochloric acid changes the urine to green. If from bilin, this may be detected by Pettinkofer's test.

II. COLOURLESS.

(A.) *Crystalline*, which may be—

1. *Oxalate of lime.*—Octahedral or quadrilateral crystals; insoluble in acetic acid, soluble in nitric and hydrochloric acids; boiling with carbonate of potash; forms soluble oxalate of potash and insoluble carbonate of lime; the former gives characteristic reactions with chloride of calcium, sulphate of copper, and nitrate of silver.

Before blowpipe becomes carbonate of lime; on continuing the heat, lime only is left, giving out heat on the addition of water, and browning turmeric paper.

2. *Phosphate of ammonia and magnesia* (triple phosphate), right rectangular or trilateral crystals; soluble in diluted mineral and acetic acids, from which, by an addition of ammonia precipitated in a crystalline form; soluble in boiling solution of potassa, with evolution of ammonia.

Before the blowpipe gives off ammonia, and runs into a white enamel; addition of phosphate of lime imparts ready fusibility.

3. *Cistine* in simple or compound tables; insoluble in boiling water, soluble in ammonia (with odour of sweet brier) and alkalies, and precipitated by acetic acid; insoluble in alcohol, tartaric and oxalic acids, and bicarbonate of ammonia.

(B.) *Amorphous* may be

1. *Phosphate of lime.*—Readily soluble in dilute hydrochloric and nitric acids, sparingly in acetic; precipitated by ammonia in an amorphous condition, forming, when collected on a filter, a horny mass; oxalate of ammonia in these solutions gives a white precipitate.

Before the blowpipe, first black and then white, leaving an ash, which is neutral.

2. *Urate of ammonia.*—Characters as above. (Coloured, B.)

Pus.—The microscope detects pus globules. The urine coagulates more or less by heat; soluble in solution of potassa, forming a tenacious glairy fluid.

Mucus.—Insoluble in potassa; imparts little or no albumen to the urine, therefore slight or no coagulability by heat, &c.

Pettinkofer's Test.—Add to the urine, by drops, two-thirds of its volume of sulphuric acid, keeping the mixture below 144°; add a few drops of a solution of cane-sugar (one to five of water), and shake the mixture, when, if bilin be present, a violet-red colour will be developed.

* *Lancet.*

THE ACTION OF SULPHUR ON POTASH, SODA, AND THEIR CARBONATES.*

BY MESSRS. M. J. FORDOS AND A. GELIS.

THE action of sulphur on the alkalies has been already studied by Berthollet, Vauquelin, and Messrs. Gay-Lussac and Berzelius. The remarkable labours of these illustrious chemists would seem to have settled every question connected with this interesting subject. On this account we have hesitated to undertake this difficult study, which could only offer us a few new facts; still the unexpected development which the chemistry of sulphur has latterly assumed, has given us confidence, and removed our hesitation.

* *Comptes Rendus.*

We know that the products of the action of sulphur on potash and soda, which we employ daily in medical practice, are known by the names *liver* of sulphur, or *hepars*. We admit two varieties of different composition. Liver of sulphur, by the dry process, which is prepared with carbonated alkalies, and considered as a mixture of polysulphuret and sulphate; and the liver of sulphur by the moist way, which is obtained by means of caustic alkalies, dissolved in water, and in which it is said the sulphate is replaced by a hyposulphate of peculiar composition.

The difference in the oxidation of the sulphur in these two compounds, a difference which we shall presently see does not exist, but which is generally admitted, induced M. Gay-Lussac to compare sulphur to chlorine, which, with the alkalies, produces chlorides, chlorites, and chlorates, according to the relative solubility of the compounds that may form the different elements in action.

We principally attached ourselves in this task to the study of what became of the oxygen, combined, in the first instance, with the alkali. As to the sulphurets which are formed at the same time, we have not in any case altered the facts discovered and described in so complete a manner by our predecessors.

I. LIVER OF SULPHUR, BY THE MOIST WAY.

The first question that arose at the beginning of these researches, was that of discovering at what temperature the sulphur removes the carbonic acid from its combination with the potash, and we discovered that the sulphur acts upon the two carbonates at very different temperatures. With the carbonate of potash the reaction begins at 176½ F., the melting point of sulphur, and it can be terminated at a temperature not exceeding 356°. The carbonate of soda, on the contrary, requires a temperature of 510°.

The examination of liver of sulphur has clearly shown us that sulphuret and hyposulphite of potash alone have been formed without the least trace of sulphate, and it was easy for us to separate the two products by means of alcohol, which only dissolves the sulphuret.

To establish the atomic proportions between the sulphuret and the hyposulphide formed, we had recourse to a method which was of great assistance to us in the course of our researches. This method was based on the employment of standard liquids, which, in the hands of Messrs. Gay-Lussac, Pélouze, and several other skilful chemists, have already rendered so much service to science.

A standard solution of sulphate of zinc served us for the purpose of estimating the sulphuret, and we determined the quantity of hyposulphite by a standard solution of iodine.

The following formula expresses this reaction.

$$3\,K\,O + 12\,S = 2\,S^5\,K + S^2\,O^2\,K\,O.$$

By employing less sulphur we obtain a polysulphuret less sulphuretted, but whatever may be the proportions, hyposulphite is always formed, and never sulphate. Liver of sulphur prepared according to the pharmacopœia, and all the livers of sulphur of commerce that we have analysed, had a singular composition.

A red heat not being necessary for the formation of this product, it appeared natural to us to suppose that Messrs. Vauquelin and Berzelius operated on a product changed by the action of the high temperature to which it had been submitted, and that the sulphate of potash, discovered by these chemists, instead of being one of the elements of the reaction, was only one of the products of the decomposition of the hyposulphite. This opinion has been confirmed by our examination of the action of heat on the hyposulphites of potash and soda, which, at above 572° F., is separated into three equivalents of sulphate, and one equivalent of sulphuret.

If, in the place of carbonate of potash, we employ that of soda, we obtain the same reaction, but it only takes place, as we have already said, at a high temperature nearly equal to 536° F., so that it is difficult, unless we take great precautions, to obtain a liver of sulphur entirely free from the sulphate, for it is only formed at a temperature nearly equal to that at which the hyposulphite is decomposed. The carbonates of baryta and lime, which are only attacked by the sulphur at a very high temperature, far beyond that which can be determined by the mercurial thermometer, yield a product containing no hyposulphite.

II. LIVER OF SULPHUR BY THE HUMID PROCESS.

All we know as to the composition of liver of sulphur by the humid process, is due to Messrs. Gay-Lussac and Berzelius. The latter admits of the presence of a hyposulphite of a peculiar composition, in which each equivalent of the base would be combined with a quantity of acid, containing three equivalents of sulphur.

This composition, which appeared singular to M. Berzelius himself, but which he nevertheless admitted, on account of the constancy of the analytical results on which it was founded, is inadmissible at the present day, when opinion is better fixed as to the satu-

rating power of hyposulphurous acid. Every thing, in fact, induces us to believe that this acid can neither form acid nor basic salts, at least, all our endeavours directed to that end have been unsuccessful, and we have also proved that the pretended bibasic hyposulphites, SO MO, whose formation is said to take place during the action of sulphurous acid on certain metals, has been improperly received by science.

We might have concluded that the reaction ought to have been the same as in the preparation of liver of sulphur by the dry method; but, still, it was necessary to prove this by experiment, for the compound, produced under these conditions, might be one of the acids of sulphur recently discovered, and the proportion of one to three between the base and the sulphur pointed out by the illustrious Swedish chemist, might cause one to believe in the existence of the salt of M. Langlois. But this is not the case, the product is always the same, whether prepared with caustic or carbonated alkalies, by the dry method or the moist. Among all the oxygenated compounds of sulphur, hyposulphurous acid is the only one produced in this reaction, and it exists in liver of sulphur in the state of a neutral salt, that is to say, each equivalent of the base saturates a quantity of acid, containing two equivalents of sulphur.

The product to be examined was always prepared free from the access of air, the glass balloon in which the combination took place being closed by a bent tube, 0m ·74 in length, and immersed in mercury. This disposition of the apparatus enabled us to collect the gas, whenever it is produced, and we have not been a little surprised to see a current of sulphuretted hydrogen disengaged, the whole time the sulphur was in a state of ebullition in the alkaline liquid.

This disengagement was accompanied by the production of a hyposulphite, which varied in each operation, and which was so much the more abundant as the boiling had been longer continued.

This increase of the hyposulphite prevented our determining by analysis the atomic proportions we had theoretically laid down.

It is therefore evident that the sulphuret, saturated with sulphur, decomposes water, and that this fact, which was unknown to chemists, might frequently be the cause of error in the results they obtained. But how does this decomposition of water take place? To give a satisfactory explanation we are obliged to examine the state of the sulphurets in their solutions. M. H. Rose, in his work on the sulphurets, discovered, that when we treat, successively, sulphuret of barium, with small quantities of water, we obtain, in the first portions of the liquid, a hydrosulphate of the sulphuret, and in the latter, oxide of barium. He also saw that the concentration of a solution of sulphuret of barium caused a disengagement of sulphuretted hydrogen, at the same time that oxide of barium is precipitated. Analogous results were exhibited by the sulphuret of strontian, and that of calcium, and he was induced to consider that the sulphurets of the metals of the alkaline earth were transformed into oxides or hydrosulphates of sulphurets, at the moment of their dissolution. This theory, based on experiment, is acknowledged by chemists. Can it be applied to the solution of the sulphurets of potash and soda in water? M. H. Rose was unable to arrive at any conclusion based on experiment.

Chemists were slow in accepting M. H. Rose's theory as applied to the solution of alkaline sulphurets; nevertheless, it is the only one that readily accounts for the reaction of sulphur on sulphurets, on which we are at present engaged. Supposing, in fact, that the sulphuret of sodium should be converted into an oxide and hydrosulphate of sulphuret, in the watery solution; what would occur if we were to boil the solution? Heated by itself it undergoes no apparent change, the hydrosulphate of soda is not decomposed by the heat of boiling water, and soda and hydrosulphuric acid are found in proper proportions for saturation; but, if we introduce sulphur, it will be quite otherwise; the sulphur will react upon the soda, so as to produce a fresh quantity of sulphuret and hyposulphite; it also reacts on the hydrosulphate of the sulphuret, and M. Thénard has shown that this reaction produces sulphuretted hydrogen.

In conclusion, it remains for us to explain why the results obtained by M. Berzelius differed from ours. It is necessary for this purpose to give a summary of the manner in which this chemist operated.

M. Berzelius did not isolate the compound $S^3 O^3$ MO, after having, like us, prepared a solution of liver of sulphur, protected from the access of air; he digested it with hydrated oxide of copper, for the purpose of removing the sulphur it contained in the state of a sulphuret; then, after having filtered it, he made two determinations, that of the sulphur of the hyposulphite, and that of the whole quantity of the potash employed in the experiment, that remained in the liquids, and he found, for 3 equivalents of sulphur, 4 equivalents of potash.

As he was satisfied by a previous experiment, that the liquid contained hyposulphurous acid, he had a right to expect the presence of a peculiar hyposulphite, because for

1 equivalent of potash he found 3 of sulphur in the hyposulphite.

This conclusion would have been strictly correct, if the means of analysis employed by M. Berzelius, had not been erroneous, and if no extraneous circumstance had acted on the sulphuret by oxidizing it. But this was not the case, and he might have obtained by his calculation, a still larger amount of sulphur, for the sulphur he discovered not only represents the sulphur of the hyposulphite necessary for the reaction, but also that of the hyposulphite arising from the decomposition of the water, the quantity of which varies according to the degree of ebullition; and, finally, the sulphur arising from a third quantity of hyposulphite that must necessarily be formed during the digestion of the sulphuret with the hydrated oxide of copper; because, in this case, the oxide of copper not only changes its equivalents of oxygen for an equal number of equivalents of sulphur, it also exercises an oxidating power upon it, as we have many times satisfied ourselves, and it is the fear of this oxidation, which we foresaw, that caused us to employ, when we commenced our experiments, the salts of zinc as desulphurants.

This property of oxidating the alkaline sulphurets does not solely belong to the blue hydrated oxide of copper, it is also a property of the calcined oxide of copper, which we employ in the combustion of organic substances. This action is equally exercised on the monosulphurets and polysulphurets, both hot and cold, and the quantity of hyposulphite formed is greater or less, according to the conditions of the experiment.

Such is a clear summary of the experiments we made as to the action of sulphur on the alkalies, and we hope that our time has not been entirely lost, and that this will be useful to chemists, by establishing facts, and causing several of the absurdities, and contradictions to disappear, which are met with in former works.

FORMATION AND PREPARATION OF HYPOSULPHITE OF SODA.*

BY E. F. ANTHON.

When dry sulphurous acid is passed over dry sulphuret of sodium, the substances do not act on one another; but in the presence of about 20 per cent. water the sulphurous acid is very rapidly absorbed, provided the sulphuret contains an excess of carbon, and is not fused, but only caked together. During this absorption a considerable development of heat takes place, and at the same time the sulphuret of sodium becomes quite moist. Upon this a disengagement of sulphuretted hydrogen is perceptible; and as soon as this has ceased, the product yields with water a colourless solution free from sulphuret of sodium, and which, therefore, soon becomes converted, on exposure to the air, into sulphite and sulphate of soda. Scarcely a quarter of an hour is requisite for obtaining small quantities, and from the crude carbonaceous mass crystallised hyposulphite of soda can readily be prepared. For technical purposes the passing the sulphurous acid into the sulphuret of sodium must be discontinued before the evolution of sulphuretted hydrogen has quite ceased, that it may still contain a little sulphuret of sodium, and so a hyposulphite of soda be obtained which is permanent in the air.

* *Buch. Rep.*, xlii. p. 20.

ON A NEW PROCESS FOR OBTAINING FORMIC ACID, AND ON THE PREPARATION OF ALDEHYDE AND ACETIC ACID BY THE USE OF THE BICHROMATE OF POTASH.*

BY PROF. W. B. AND R. E. ROGERS.

I. PROCESS FOR FORMING ACID.

Since the important discovery of Döbereiner, that formic acid is evolved from a mixture of tartaric acid, peroxide of manganese and sulphuric acid, the progress of research has shown that in a large proportion of cases, where organic matters are exposed to powerful oxidating agencies, this acid is among the products developed; and hence several other processes have been devised for its preparation on the large scale and in the laboratory. Of these the one generally in use consists, as is well known, in distilling a mixture, in prescribed proportions, of peroxide of manganese, dilute sulphuric acid and starch or sugar.

The inconsiderable amount of acid yielded by this process, and its usually large admixture with other products, especially sulphurous acid, suggested to us, some time ago, the trial of bichromate of potash as a substitute for peroxide of manganese, and has since led us to a method of operating which we think presents decided advantages over that in general use.

When bichromate of potash, dilute sulphuric acid and sugar are mingled in proper proportions and in proper order, a large

* *Silliman's Journal.*

amount of formic acid is developed, of which, part passes off during the first violent reaction, and the remainder is separable by gentle distillation. Repeated experiments have convinced us that by mingling all the materials at once, before placing them in the retort, a comparatively small product is obtained, partly from its being volatilised by the high temperature attending the reaction, and partly, we think, because more of the sugar is carried to its highest state of oxidation in the forms of carbonic acid and water. We have therefore been led to another, and we believe, better mode of operating, of which the following details will serve as an example.

Introducing into a retort, capable of holding about 1 quart, 800 grs. of bichromate of potash and 10 cubic inches of water, we gently heat the mixture so as to dissolve the larger part of the bichromate. We then add 300 grs. of powdered white sugar, and adjusting to the tubulure a perforated cork and pipette with gum-elastic bag for the gradual introduction of sulphuric acid, we slowly inject about 1 cubic inch of the latter upon the mixture. By regulating the addition of the acid and occasionally intermitting the slender stream, the violent reaction which ensues is prevented from occasioning any very great intumescence. During this stage of the operation, upwards of 2 cubic inches of a clear but feebly acid liquid passes over into the receiver. When the action has in a good measure subsided, we add 5 cubic inches more of water, and apply a gentle lamp-heat, continuing the addition of the acid, by allowing it simply to drop from the pipette, until another cubic inch has been introduced. The liquid which now passes over is much stronger in formic acid than in the preceding stage, and the distillation may, without imparing the purity of the product, be continued until about 7 cubic inches have been received. By urging it much beyond this point sulphurous acid will be evolved.

100 grs. of the liquid thus obtained is capable of saturating about 7 grs. of dry carbonate of soda. Its purity is such as to fit it for immediate use in illustrating the striking reactions of formic acid and the formiates. Thus—

1. On adding a small portion of it to a solution of nitrate of silver previously curdled by ammonia, and applying heat, the silver is promptly reduced with a lively effervescence of carbonic acid.

2. With a solution of bichloride of mercury, aided by heat, it causes a precipitation of calomel and the evolution of hydrochloric and carbonic acids.

3. Combined with soda it forms a white salt readily carbonised by heat and passing into carbonate.

4. It is not blackened by sulphuric acid, but the soda salt acted upon by this acid evolves carbonic acid with brisk effervescence.

This salt, heated with solution of nitrate of silver or nitrate of mercury, precipitates the metal with evolution of carbonic acid.

All these results are so prompt and striking, as to evince but little contamination of the formic acid with other products.

On comparing this process with that commonly employed, we are convinced of its superiority,—1st, on account of the exemption of the product from SO^2, and in a great degree from other impurities; 2nd, from the much larger amount of formic acid obtained by it from an equal weight of the oxidising material, sulphuric acid and starch or sugar; and 3rd, from the ease with which the action is controlled.

According to Liebig (*Chem. Org.*, p. 567), 10 parts of starch, 37 of peroxide of manganese and 30 parts of sulphuric acid, yield 3·35 parts of an acid liquid, of which 100 grs. saturate 15 grs. of carbonate of soda. This corresponds to 7·18 parts of liquid, such as we obtain. We have thus, by the old process, 7·18 parts of liquid of equal acidity with our product, while the aggregate weight of the starch, sulphuric acid, and peroxide of manganese, is 77. By our process we have about 1,800 grs. of a similar acid from 2,100 grs. of sugar, bichromate of potash and sulphuric acid. In other words, by the new process we procure about 9 times as much formic acid from the same weight of the three reacting materials as by that hitherto in use.

II. ON THE PREPARATION OF ALDEHYDE AND ACETIC ACID BY THE USE OF THE BICHROMATE OF POTASH.

In the process described by Liebig (*Chem. Org.*, p. 378), and which is the one hitherto generally used for preparing aldehyde in the regular way, the product is obtained from the reaction of peroxide of manganese and sulphuric acid upon dilute alcohol. This operation furnishes a liquid which is so weak in aldehyde, and so mixed with water and formic ether, and as we have found with acetic acid also, as to present the characteristic reactions only in a feeble degree, and to require two rectifications over chloride of calcium, before it can be used in forming the subacetylite or aldehydite of ammonia.

In the course of some experiments upon the reactions of bichromate of potash and sulphuric acid upon alcohol, we have been led to a process which affords a larger and much purer product, and which is entirely under the control of the operator.

The distinctive features of this method are the substitution of bichromate of potash for the peroxide of manganese, and the peculiar mode of bringing the reacting materials together. In the use of the bichromate we have found that we were anticipated by Professor Kane, who, at page 922 of his *Elements of Chemistry*, recommends it as a means of obtaining a purer product, and specifies briefly the manner in which he conducted the process. As however his method is not noticed in other chemical works, and as our mode of proceeding, and some of the results we have obtained, are, we think, not without novelty and interest, we deem them worthy of a brief notice in your Journal.

When alcohol is added to a strong aqueous solution of chromic acid in a retort, a very brisk reaction ensues, and upon applying a gentle heat, there passes over a clear liquid, containing a considerable amount of aldehyde, with a faint trace of acetic and probably formic acids. The presence of the aldehyde is readily shown by adding a few drops of the liquid to a solution of nitrate of silver previously curdled by ammonia, and then gently heating the mixture. The oxide is speedily reduced, forming a brilliant metallic coating on the side of the glass.

Substituting for the chromic acid of this experiment a mixture of bichromate of potash and sulphuric acid, and blending with this a quantity of common alcohol, the reaction is extremely violent, a large volume of carbonic acid is evolved, and the liquid which distils over contains, with other products, much aldehyde and acetic acid. To obtain either of these substances but little mingled with the rest, special attention must be paid to the proportions in which the bichromate, sulphuric acid and alcohol are mixed, and to the order in which they are brought together. Thus, in all our experiments, we found that when alcohol is added in small quantities at a time to a mixture of the bichromate and sulphuric acid, the distilled product is almost pure acetic acid; but when sulphuric acid is *slowly dropped* into a mixture of the salt and alcohol, the liquid which passes over contains little else than aldehyde.

This remarkable difference in the products is, we think, readily explained by the different intensity of the oxidating power in the two cases. In the former, the alcohol, as it falls into the mixture of bichromate and sulphuric acid, being surrounded on all sides by free chromic acid, is carried rapidly through the lower stage of oxidation, corresponding to aldehyde and aldehydic acid, until by the addition in all of 4 equivs. of oxygen, and the elimination of 2 equivs. of water, it is converted into acetic acid. In the latter case, the sulphuric acid, dropping slowly into the mixture of alcohol and bichromate, liberates but a small quantity of chromic acid at any one time, and thus limits the oxidation of the alcohol in great part to the first stage, or that of the formation of aldehyde.

From the observation of these facts we were led, after a number of comparative trials, to the following process for the preparation of aldehyde.

Equal weights of powdered bichromate of potash and alcohol, spec. grav. 0·842, being placed in a capacious retort, connected with a receiver and the usual means of refrigeration, we adapt to the tubulure a pipette, charged with sulphuric acid, and whose stem reaches nearly to the surface of the liquid, the top of the pipette being furnished with a strong gum-elastic bag for ejecting the acid into the mixture beneath. We now slowly add the acid, taking care to avoid excessive reaction, by sometimes allowing it merely to drop spontaneously from the pipette, and again when the action subsides accelerating its flow by pressure. At this period of the operation, the heat evolved in the retort is sufficient to carry over into the receiver a considerable volume of the aldehydic liquid; and as much carbonic acid is at the same time disengaged, the tubulure of the receiver should only be loosely closed. Having thus added gradually a weight of sulphuric acid equal to about 1¼ that of the bichromate, we apply a gentle lamp heat, and continue the distillation as long as the aldehydic liquid passes over. When the reaction is most energetic, white fumes are evolved, which, falling from the beak of the retort into the receiver, are so dense that they may readily be poured from the latter through a funnel into a narrow-necked bottle. These, when condensed, form a clear liquid consisting chiefly of aldehyde.

By this process 1,500 grs. of bichromate of potash, and the same amount of alcohol, have on repeated occasions yielded about 8 cubic inches of a clear liquid, containing but slight traces of acetic acid or other extraneous matters, and possessing all the characters of a nearly pure mixture of aldehyde and water.

The product thus obtained is sufficiently rich in aldehyde to exhibit instantly and strikingly all the characteristic reactions of that substance. It may, therefore, without rectification, be employed in class-room experiments and in testing for silver.

A few drops of this liquid, added in a test-tube to a solution of nitrate of silver previously curdled by ammonia, quickly

converts the oxide into metallic silver, which attaches itself as a brilliant coating to the glass. In describing this characteristic property of aldehyde, Liebig and others appear to regard the application of heat to the mixture as necessary to the effect (*Chem. Org.*, p. 377). We have found, however, that the aldehydic liquid of the above process, as well as the more concentrated aldehyde procured from it by distillation over chloride of calcium, causes a complete and brilliant reduction of the oxide of silver in a few seconds at ordinary temperature, and that the same effect results even when the tube is immersed in snow, but in this case the change requires two or three minutes for its completion.

Heated with hydrate of potash, the liquid becomes yellow, then of a deep reddish-brown colour, and in a little while yields floating flakes of the characteristic resin of aldehyde.

On adding to the liquid an excess of caustic baryta in the cold, little or no action is manifested; but as soon as heat is applied, the mixture assumes an intense opaque yellow colour like that of chromate of lead, which by continuing the heat passes into a deep rich brown, as in the preceding experiment.

The proportion of aldehyde in the liquid as it comes from the receiver in the above process is such, that to prepare aldehydite of ammonia we may dispense with the two successive distillations from the chloride of lime directed by Liebig, and use the fresh product at once for this purpose. We therefore add to the liquid about half its bulk of sulphuric ether, and pass a stream of ammonia into the mixture. As the aldehyde becomes saturated, the compound in question falls in an abundant deposit of brilliant transparent rhombohedral crystals. From this, as is well known, perfectly pure aldehyde is prepared by the reaction of dilute sulphuric acid.

In some experiments, made to determine the delicacy of aldehyde as a test for oxide of silver, we obtained the following results:—

1. A solution of 1 part of nitrate of silver in 1000 of distilled water, when heated gently in a test-tube with a drop or two of aldehydite of ammonia, formed a brilliant metallic pellicle on the inner surface of the glass.

2. A solution containing 1 part in 2000 produced the pellicle in distinct spots, and not continuous as in the former case. At the same time the liquid became of a deep greenish-purple colour, and, although only 1 quarter of an inch thick, was nearly opaque.

3. A solution of 1 part in 10,000 gave no adherent pellicle, but on continuing the heat for two or three minutes, became strongly coloured, presenting a deep greenish-purple by transmitted, and a dull olive by reflected light.

4. In a solution of 1 part in 20,000, the peculiar greenish-purple tint was still quite decided; and even when the solution was diluted so as to contain only $\frac{1}{40000}$th of nitrate of silver, this colour was very distinctly manifested after heating it for some time with aldehydite. Compared with the faint opalescence caused by the addition of chloride of sodium to the same solution, this effect of the aldehyde appeared to be the more striking of the two.

The peculiar purplish tint of the liquid, remarked in these experiments, is evidently due to the finely-divided metallic silver held in suspension, and affords therefore a striking confirmation of the statement of Dupasquier, that not only gold, but silver and other opaque bodies, present this view when greatly subdivided and viewed through a clear suspending medium (*Comptes Rendus;* No. 1, July, 1845). It may be added, that the same hue is developed when a very dilute solution of nitrate of silver is subjected to the reducing action of a formiate.

Allusion has already been made to the production of *acetic acid* in large amount by a modification in the above process. For this purpose the powdered bichromate and the sulphuric acid, in the proportion of about 2 to 3, are to be first mixed in the retort, so as to develop a large amount of free chromic acid. The alcohol is then introduced from the pipette as in the former case, and with like precautions. During the violent action that ensues, much acetic acid passes over without the aid of external heat. When the alcohol thus added amounts to about twice the weight of the bichromate employed, the action having subsided, we apply a gentle lamp heat, and obtain a large additional quantity of the acid. This we have found to be free from sulphurous acid, and to contain little more than a trace of formic acid and aldehyde.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

IMPROVEMENTS IN THE MANUFACTURE OF EARTHENWARE PASTES AND VITREOUS BODIES, AND A NEW COMPOSITION AND MATERIAL FOR THE SAME, WITH CERTAIN NEW MODES OF COMBINATION THEREOF.

BY GEO. SKINNER.

THIS invention relates, firstly, to the use and manufacture of a new composition and material, being a combination of chalk, or carbonate of lime, and silica, in proportions with other ingredients hereafter named, to form vitreous pastes, which they call artificial marble, or marble pastes.

Secondly, to lessen the expense and improve the qualities of earthenware and pottery by the addition of this new composition —chalk, or carbonate of lime, and silica, in certain proportions with other ingredients hereafter named; and by which a whiter earthenware can be made without the use of cobalt as a stain, and with the use of a less quantity of ground silica.

Thirdly, to effect the glazing of earthenware or pottery without the use of lead, or any other deleterious materials, and without the use of acids, alkalies, or other expensive materials.

And, lastly, the application of such vitreous pastes, artificial marble, or marble pastes, and glazes, when prepared, as aforesaid, to the manufacture of certain known and useful articles. The advantages of this invention are as follows:—With respect to the first part thereof, by the use of the composition of chalk, or carbonate of lime, and silica, in the proportions, and with the other materials, hereinafter mentioned, and described under the heads No. 1 and No. 2, and which relate to this portion of the said invention; vitreous or marble pastes are produced, which, when burnt, resemble marble, with properties more durable; it can be ground and polished, and will combine with many colouring metallic oxides, such as oxide of chrome, &c., which, like dyes, pervade the mass, and produce the most delicate tints, or strong, clear, and distinct enamel colours; and which can be worked in the mass or in relievo, or in any other suitable manner; being vitreous from fusion, abrasion or wear cannot destroy or alter its tint, and, having no artificial glaze on its surface, it maintains its original appearance throughout the entire mass. These pastes, when prepared and worked up into shape, can be painted or printed and finished by one process of firing, if so desired.

The invention relates to the means of producing a whiter earthenware, without the use of cobalt as a stain, and also with the addition of a less quantity of silica than is generally used in the manufacture of earthenware bodies, thereby effecting a considerable saving in expense of the composition of such bodies, and rendering them better adapted to receive the glaze in their biscuit state. It also retains its form and whiteness in the degree of heat requisite to vitrefy the glaze on its surface, and thereby secures an increased brilliancy to the fritted glaze now generally used by potters, and that either for the white or painted earthenware.

The injurious effect of the use of the compounds of lead has long been known, not only as repects the health of the workmen, but also that the articles manufactured, and to which these compounds are added, are liable to be acted on by acids and other corrosive matters. These compositions prepared, as hereinafter described under the heads Nos. 5 and 7, and which relate to this part of this invention, do away with the use of lead and other deleterious materials in the manufacture of earthenware and pottery, and also in the glazes used for the same, for using in certain proportions only such materials as enter into the composition of the bodies of pastes, earthenware, and pottery, prepared after these methods; durable glazes, at much less expense, without the use of any of the compounds of lead, acids, alkalies, or any of the salts, or other expensive materials, can be prepared.

The new composition of material, the modes or methods adopted in preparing and mixing the same, together with the several proportions of the materials used, are described under the following heads:—

No. 1. A marble paste.
No. 2. Another marble paste.
No. 3. A white earthenware body.
No. 4. A semi-vitreous body.
No. 5. A composition for a glaze without lead.
No. 6. A porous earthenware body.

No. 7. Another composition for a glaze without lead. The modes or methods adopted in preparing and mixing all the materials used for the composition relating to each head above named, and hereinafter particularly described as follows :—

It is necessary to reduce them separately to powder, mixed with water, and brought into a pulp, and afterwards sifted in the same way as the preparation of clays and other materials now used by potters usually are; these pulps or slips must then be brought to a given weight, varying from twenty-four to thirty-two ounces to the imperial pint, or in other suitable proportions.

When brought to a suitable given density or weight, they are either severally mixed and combined in the proportions hereinafter mentioned, or they can, as they are prepared, be treated as pulps, and then be mixed together when they are required for use; if, however, they are required at once for use, having been mixed and combined in the manner hereinafter mentioned, they are to be sifted, or passed through a fine sieve, and it is preferable, after they have been once sifted, to sift them a second time, whereby the mechanical combination will be more complete. After they have been sifted, they are subjected to the mode of treatment usually adopted by potters in preparing materials from pulps, prior to working up; and the pastes or bodies, when ready, are worked up in the usual manner, and are moulded and applied in a variety of shapes and forms unnecessary to particularise.

When they are so worked up, the articles into which they are formed are placed in seggers, and the seggers put into the potter's biscuit kiln, which is raised to a proper heat, usually from 45 to 62 of Wedgewood. The degree of heat applied will, however, depend upon the particular proportions of the materials used in the compositions, and whether the articles being made are required for any specific object. The degree of heat is best ascertained by trial pieces placed in the biscuit kiln. The materials used in preparing the composition and material, and the proportions in which they are mixed are as follows :—

No. 1.—MARBLE PASTE.

	To the Imp. Pint
2 pints of silicia, flint or silex ..	32 oz.
3 pints of chalk, or carbonate of lime	28 ,,
2 pints of Cornwall stone	32 ,,
3 pintsof China clay	24 ,,
9 pintsof ball clay, slip	24 ,,

No. 2.—MARBLE PASTE.

	To the Imp. Pint
1 pint of chalk, or carb. of lime..	2½ oz.
1 pint of silicia, flint, or silex in pulp	32 ,,
1 pint of China clay	24 ,,
1 pint of Cornwall stone	32 ,,
1 pint of ball clay	24 ,,

The vitreous or marble pastes may be tinted any desired colour or shade, by the use of metallic oxides; for instance, if cobalt is added in proper proportion, a blue marle paste will be the result, on their proper union, by means of heat; and a green colour may be produced by the addition of oxide of chrome.

No. 3.—WHITE EARTHENWARE BODY.

	To the Imp. Pint
2 pints of chalk, or carb. of lime	28 oz.
3 ditto of silica, flint, or silex ..	32 ,,
5 ditto of ball clay	24 ,,
10 ditto of China clay	24 ,,
1 ditto of felspar or sulphate of barytes	32 ,,

15 pints of China clay instead of 10, and no ball clay, will render it whiter.

No. 4.—SEMI-VITREOUS OR CHINA BODY.

	To the Imp. Pint
4 pints of silica, silex, or flint ..	32 oz.
3 ditto of chalk, or carbonate of lime	30 ,,
6 ditto of ball clay	24 ,,
8 ditto of China clay	24 ,,

1 pint of felspar will make it more vitreous.

No. 5.—COMPOSITION FOR A GLAZE WITHOUT LEAD.

	To the Imp. Pint
1 pint of chalk, or carbonate of lime	28 oz.
3 ditto of felspar	28 ,,

No. 6.—POROUS EARTHENWARE BODY.

	To the Imp. Pint
3 pints of silica, flint, or silex ..	32 oz.
5 ditto of ball clay	24 ,,
2 ditto of chalk, or carbonate of lime	28 ,,
10 ditto of China clay	24 ,,

The purity and quality of these several compounds, depend upon the quality of the materials used in their combination. The compositions No. 1 and No. 2 do not require to be glazed; No. 3, No. 4, and No. 6, can be varnished without the assistance of lead

or any of its compounds, by glazes formed principally of the same, or like material, of which such bodies or pastes are compounded, but mixed in different proportions. The inventor wishes it to be understood, that if it is required, any of the compounds of lead and other materials usually used in the manufacture of glazes for pottery or china of any description, can be used on the bodies or combined with the glazes employed: but they do not think it advisable to do so, unless for printed ware; and also, that the glazes prepared can be used to glaze any description of pottery, earthenware, of china, made of the usual materials employed for such purpose.

The glazes are prepared as follows:—the materials must be previously reduced and prepared in the same manner as the powder, pulp and slip for the compositions hereinbefore mentioned for the bodies or pastes.

No. 7.—ANOTHER COMPOSITION FOR A GLAZE WITHOUT LEAD.

	To the Imp. Pint.
1 pint of silica, flint or silex....	32 oz.
2 ditto of chalk, or carb. of lime	28 ,,
1 ditto of China clay	24 ,,
8 ditto of Cornwall stone.....	82 ,,
4 ditto of felspar	28 ,,
1 ditto of ball clay	24 ,,

The method in which these glazes are used is as follows:—Any article of pottery or china having been prepared in the usual manner, by moulding or otherwise, of any of the compositions, Nos. 3, 4, and 6, above described, are placed in the kiln, and brought to the biscuit state; after which it is taken out, and dipped into it in the usual manner; and it is afterwards placed in the kiln, and fired with a suitable but greater degree of heat than is used in bringing it into the biscuit state, and which can be ascertained exactly by the trial pieces; and it is allowed to remain there a proper time—usually about twenty-four to thirty hours, but depending on the size of the kiln—or until properly finished, as can be ascertained by examination from time to time by trial pieces. The two glazes hereinbefore described, require the addition of a small portion of fine-ground cobalt, as a stain, in the proportion of about 2 oz. to 400lbs. of either composition of the glazes, and by which will be produced beautiful porcelain and earthenware glazes, and much superior to those compounded of lead or borax.

If a glaze be required more transparent, for printed and painted pottery, china, or earthenware, than those described, it can be made by the addition of any desirable quantity of the following fritt to these glazes, in small proportions, which proportions will range from one proportion of fritt to two proportions of either of the glazes No. 5 or No. 7. The proportions of such fritt are as follows:—

100lbs. of ground silica, silex, or flint, in dust.
60lbs. of boracic acid.
70lbs. of soda.
50lbs. of whiting.

The materials of this fritt must be mixed together, and may be put into a fritt kiln now used by potters, or in seggers lined with silica or flint, and submitted to the heat of the potter's glost oven for a suitable time, usually twenty hours; it is then taken out, and allowed to cool. It is afterwards reduced to powder, pulp, or slip in the manner hereinbefore mentioned, and then added in any requisite proportions, to either of the glazes No. 5 or No. 7.

The inventor claims, firstly, the use and combination of chalk, or carbonate of lime, in union with silica, flint, or silex; and the compounding of these substances when prepared as aforesaid, or in any other suitable manner in the proportions hereinbefore mentioned, or in any other suitable proportion or quantities, with all or any of the other substances or materials hereinbefore named and described, or other suitable substance or substances, for the purpose of forming vitreous pastes, artificial marble, marble pastes, bodies, and glazes for any of the articles or purposes hereinbefore mentioned, or other similar useful articles or purposes, or for pottery, china, earthenware, or other such like vitreous or vitrifiable bodies; and, secondly, they claim the use and preparation of the compositions, pastes, bodies, and glazes, hereinbefore mentioned, made in the proportions of the materials or substances and prepared and treated in the peculiar modes or methods hereinbefore stated; but they do not confine themselves thereto, or to the precise forms, proportions, or details shown, so long as the peculiar character of any or either part of the invention be retained.

IMPOVEMENTS IN THE MANUFACTURE OF AERATED WATER.*

BY ARCHIBALD DUNLOP, JUN.

THIS invention refers to the manufacture of aerated water containing bicarbonate of lime in solution; a patent for which was granted to W. Maugham, January 31st, 1843; it consisted in passing carbonic acid gas into a solution of caustic lime in water; but, ac-

* *Newton's London Journal.*

cording to the present invention, carbonate of lime, in a finely divided state, is mixed with water, and caused to dissolve therein by conducting carbonic acid gas into the vessel containing the mixture. The patentee states, that by this method of operating he can not only obtain an aerated solution of bicarbonate of lime of a similar strength to that heretofore made, but, if desired, of even greater strength.

The carbonate of lime used in making the aerated water should be obtained as pure as possible, and in a minute state of division, which may be done by employing white Carrara marble, reduced to a fine powder by mechanical means; or by precipating carbonate of lime from lime water by means of carbonic acid; or by employing a soluble salt of lime, such as muriate of lime, and precipitating pure carbonate of lime therefrom by means of carbonate of soda. The pure carbonate of lime is mixed with water, in the proportion of sixteen grains or upwards to each pint of water, and is kept mechanically suspended by means of a suitable apparatus. The mixture, while yet turbid, is transferred to another apparatus, such as is used in manufacturing soda-water, and strong enough to resist a pressure of at least 540 lbs. on the square inch; and the carbonate of lime is dissolved by introducing carbonic acid into the vessel: the patentee ascertains when the carbonate of lime is dissolved by withdrawing a small quantity of liquid from the vessel, and if it be perfectly clear and transparent the process is complete. The aerated solution of bicarbonate of lime is then bottled in the ordinary manner.

The patentee claims, as his invention, the mixing carbonate of lime, finely divided with water, and applying carbonic acid thereto, so as to produce an aerated solution of bicarbonate of lime.

ON THE USE OF GUANO.

BY PROFESSOR JOHNSTON.

At a public breakfast at the Wakefield Meeting of the Royal Agricultural Society, Professor Johnston observed, on the subject of Guano Manure, that he had not risen so much to deliver a formal lecture, as to give an opportunity to the gentlemen present to state the results of the different experiments they had made. Facts might be different, and observations might be different, but one fact or one observation did not contradict another fact or another observation. The difference was in the conclusions that were drawn from them. One gentlemen, from the observation he had made, might say that guano was of no use; but that was an error of opinion; the fact upon which he had founded that opinion did not contradict the fact upon which another gentleman might have formed a totally different opinion. Both facts might be true; but what they wanted was some principle which would explain both. One thing he particularly wished to impress upon them was, that in the present condition of agricultural science, they should let their opinions hang loosely upon them, and not adhere to them as heir-looms. There was no opinion on the subject of agriculture which was not susceptible of modification, and made more applicable to advancing knowledge. With regard to guano, it was well known it was derived from a description of sea-fowl which lived upon fish and was produced in great abundance. If they fed some fowls on the ordinary food, and others on fish, they would find that the manure of the latter was much more valuable than that of the former. There was another fact with regard to the manure of birds generally. It was well known that the excrements of animals, of cows, of horses, of sheep, &c., consisted of solids and liquids. In the solids were found the phosphates; from the liquids the ammonia was obtained, or, at least, the nitrogen which formed the ammonia on fermentation. Now in the excrements of the sea-fowl and other birds, the liquid and the solids were ejected together, and consequently were more valuable. This was an important point. Hitherto, only the solid excrements of animals had been really attended to. They did not contain all that the farmer wanted; they did not contain the ammonia and saline qualities which the liquids carried off. It was not necessary he should say much on the theoretical advantages of guano. Nor was it of much importance to them; but they would find from the market value of its main constituents in what its advantages really consisted. Ammonia was the principal fertilizing ingredient, and the price of that was from 30s. to 2*l*. per ton. In guano there was 55 per cent. of ammonia, and a large proportion of phosphate of lime. These two articles constituted the great proportion of guano, as well as the most valuable in the market. He had already told them that the sea-fowl ejected in one excrement both ammonia and the phosphates, whilst in animal excrements the phosphate was contained in the solid, and the ammonia in the liquid. He would draw attention to some of the varieties of guano which had recently come into the market, in order that they might compare them with those which had already come into use. These varieties had been brought from Saldanha Bay and Patagonia. The former variety contained seventy or eighty per cent. of phosphorus, and was very rich, and the Patagonia guano was as good as the better qualities of Ichaboe guano. It was a subject of congratulation, that on the coast of Patagonia there was a very large supply of guano, and he hoped that the guano from all parts of the world would last the farmers as long as they would require it, and that by the time this manure failed, they would be able to dispense with it. He thought it a most gratifying cir-

cumstance that Providence had thus interfered to cause knowledge in these matters to flow in the right channel. When guano failed, still the use of artificial manures would not stop. He anticipated that artificial manures would then be prepared, if not by manufacturers, at least by the farmers themselves, many of whom would be able to prepare them. Their business at present, however, was with the guano as they found it. Three or four cwt. of guano was equal to twenty or thirty tons of farm-yard manure. He had alluded to its theoretical value, and if the time had permitted him to explain all the things the plant requires, he could have shown them that this guano, to a great extent, supplies all the demands of the crops. The result of his inquiries in the country had shown that it was better husbandry to use half guano and half farm-yard manure; or, if they did not do that, to use guano the first year and farm-yard manure the next. But, in his opinion, the safest way, in all cases, would be to use half dung and half guano, as larger crops, generally speaking, had been obtained in this manner. He thought it was not the best or the most economical method to use guano in a dissolved or liquid state. He then alluded to the great analogy which exists between guano and bones, explaining, however, that guano acts more quickly than bones. He next noticed some experiments which had been made in Ross-shire, Scotland, with guano. A gentleman, named Ross, who resides in that county, which contained some as good land and as good farmers as in Yorkshire, wrote to his grieve or bailiff to apply guano to the land in the ratio of 4 cwt. to the acre. The grieve, thinking that his employer must be wrong, applied the guano in three several proportions. To one part he applied 4 cwt., to another 8 cwt., and to a third 16 cwt. The consequence was, that on the land where 4 cwt. were applied beautiful crops appeared; whilst the contrary was the case with the other portions, especially with regard to that portion to which the 16 cwt. had been applied. Then came the crop of wheat, for wheat was taken after the turnips. When the wheat was growing, where the 16 cwt. of guano had been applied, the straw was dark coloured, the corn was small in the ear, and when thrashed it was absolutely black. Where 8 cwt. had been applied the straw had a peculiar dark colour; where 4 cwt. had been applied the sample of wheat was beautiful, and that wheat brought in the market 6d. per bushel more than the wheat taken from the land on which 8 cwt. had been placed; and the wheat taken from the land to which 16 cwt. had been applied could scarcely be sold at all. He mentioned another case which had been brought under his notice ten days ago to show the effects of guano in promoting the growth of crops. He then drew their attention to the effects produced on the farm of Mr. Fleming, of Renfrewshire, and gave the result of the money value of three crops grown in 1842, 1843, and 1844, of turnips, oats, and rye, after the application of guano. The crops, where guano was applied, left a profit, after paying every expense for rent and interest on the capital, of 30*l.* 16s. Where farm-yard manure was applied at the rate of twenty-five tons for turnips there remained a profit of 14*l.* 16s., leaving a difference in the profit in favour of the grower, by the application of guano, of 16*l.* In the one case three cwt. of guano was used, and in the other twenty-five tons of dung. The Professor was asked what value did he put on the manure, to which he replied 8*l.* 15s. He mentioned a few other cases of a similar kind, the result being that more profit was to be obtained from the use of half farm-yard manure than when they used half guano, and farm-yard manure only, or when mixed with bones. The question would hereafter be whether they would look to the after effects of guano, or whether they would not rather look to its immediate effects, and whether they would not apply it in small quantities from year to year rather than larger quantities every four years. He believed that it would be found more beneficial to apply it to each successive crop, to apply it to the seed, and then to apply a top dressing when the plants made their appearance above ground. After trying this plan, he thought they would be satisfied it was the most profitable they could adopt. Professor Johnston then sat down amidst loud applause. In the course of his remarks, Professor Johnston referred to the following table, showing the composition of the different kinds of guano, and observed that their relative value was to be estimated, according to the proportions of organic matter, ammoniacal salts, and phosphate of lime, those sorts containing the most of these ingredients being the most valuable as manures.

COMPOSITION OF DIFFERENT KINDS OF GUANO.

	Levenside.		Star of the West.		Icebboe.	Bolivian.	Chincha.	
Water	13·75	22·85	13·50	27·66	17·41	8·34	15·99	
Organic Matter and Ammoniacal Salts	68·90	52·66	32·31	32·34	55·33	65·60	51·37	
Sulphate of Soda and Common Salt	6·94	6·51	33·50	9·80	4·92	0·78	5·00	
Carbonate of Lime and Magnesia	3·32	2·77	5·81	4·14	3·54	1·12	8·57	
Earthy Matter	5·83	3·11	1·30	3·88	0·57	4·46	2·99	
Phosphate of Lime	16·07	12·10	12·00	20·18	18·23	19·18	21·77	
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	

Mr. Lester Maw, of Tetley, near Crowle, rose to make a few observations to the company. He produced several turnips which he said had been grown on his farm from farm-yard manure. And not only was that particular land in a high state of cultivation, but he had succeeded step by step in bringing other farms into an equal state of cultivation, so that they had in fact trebled their produce. He referred to the turnips which he produced as evidence, in opposition to Professor Johnston, and to show that five or six hundred weight of guano was not equal to fifty tons of manure. He showed that the fold-yard manure was so rich that the fangs had gone out to seek for food, and he thought that they had had too much. Mr. Maw, concluded by stating some interesting details respecting the great growth of turnips without the aid of guano or any artificial manure. If the farmers would only raise sufficient fold-yard manure for themselves, which he thought they might do, they would have little occasion for guano, that if not, they might put their hands in their pockets as long as they could for the purpose of raising their crops.

Mr. H. S. Thompson said he quite agreed with Mr. Maw that farm-yard manure was a very excellent thing; the great object of guano was not, he conceived, to dispense with the use of farm-yard manure, but to enable them to carry out the cultivation of a wider breadth of land than could be adequately cultivated without it.

Mr. Thos. Short next offered a few observations. He said he had used large quantities of guano, with various degrees of success. In an experiment in which potatoes were the first and rye the after crop, he had found the bones, dissolved in sulphuric acid, had a decided superiority over guano. He dwelt upon the importance of the preservation of the manure of large towns. Valuable as guano was, it was, in his opinion, an article that the British farmer at present could do without. The solid matter contained in human manure was a great deal more valuable than guano. It had been estimated that a town containing 15,000 inhabitants was capable of producing annually 270 tons of available manure, which might be made to produce 1,000 quarters of wheat. How much better, he urged, would it therefore have been if railway speculators had formed themselves into societies for the preservation of the manure of towns, instead of directing their attention to comparatively profitless objects. (Laughter and applause.)

Mr. Geo. Legard said he had tried experiments upon grass land, with guano. He happened to have taken a farm the year before last, a portion of which was bad grass land. There was extremely poor herbage upon it. In the year 1845 a field, consisting of between 40 and 50 acres, only carried one sheep to the acre. It did not fatten it, because it came out of the field at the end of the summer rather leaner he thought than when it went in. (Hear. hear.) He was induced to try if he could not improve the grass, and in the spring of this year, he applied 3 cwt. of guano to the acre. The application was made in the month of January, or very early in February, the sub-soil was chalk, which reached within about six inches of the surface. It was a strong soil, with, he should imagine, alumina in it. The guano was put on at the rate of 3 cwt. to the acre. He was rather apprehensive that if it came a dry spring, the whole of this might be lost, and therefore he tried a method for preventing that result. He applied, in the month of May, 1 cwt. of nitrate of soda to the acre. The result of this was that the field was most productive, and instead of one sheep to the acre, the average it now carried was about four and a half sheep to the acre; and they had been very much improved indeed in condition; and at present the field was extremely full of herbage. (Applause.) In conclusion, he inquired of Professor Johnston whether he thought that nitrate of soda had a good effect, if mixed with guano, in dry weather?

Professor Johnston had no doubt it would materially assist the action of the guano, but whether it would have any effect in preventing any of the evil consequences of dry weather, he could not say.

W. R. C. Stansfield, Esq., M.P., spoke of the application of guano with tank-water. He exhibited a specimen of a crop of Italian rye grass of considerable length, which he said was the fourth cutting this year, and had been produced by mixing a certain portion of guano and tank-water. He had cut his third crop in May, and it had produced at the rate of 16 tons to the acre green crop. He expected to have three other crops this year. He mentioned that last month he had thrashed some of the grass, and obtained seeds at the rate of 40 bushels an acre. He stated that rye grass was a favourite food of cows, and so long as it lasted they would eat nothing else. In answer to a question put by a gentleman present, the Hon. Gentleman said he dressed his land over with the guano and tank-water after every crop.

EXPERIMENTS WITH LINSEED CAKE AND OTHER SUBSTANCES, IN FATTENING SHEEP AND CATTLE.

BY MR. JAMES BRUCE.

HAVING made use of a large quantity of linseed-cake for the last two or three years in fattening live stock, and being a little doubtful of its use giving a profitable return, the following experiments were conducted with the view of ascertaining its value; 1st, as an article of food, and 2nd, as a manure, when consumed upon the farm.

EXPERIMENT I.

For these ends, 27 small polled heifers were divided into three lots and weighed; one lot being put on a liberal allowance of home-made cake, another upon foreign (to determine

* *Quarterly Journal of Agriculture,*

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[illegible] suming the home-cake, B the [illegible] turnips alone. The respective [illegible] sheep on the 1st of January, [illegible] the experiment commenced, [illegible] on A 2,768, of B 2,739, of C [illegible] the 7th of February, C having [illegible] portion of turnips, was then re- [illegible] found to be 2,880 lbs., and on [illegible] h, A and B having also con- [illegible] were found to be, A 3,054, B [illegible] e quantity of cake consumed [illegible] h, was 1,182 lbs., being nearly [illegible] o each. Lot 2nd consisted of [illegible] inmonts of inferior quality, [illegible] e divisions may be designated [illegible] F; D getting home-cake, E [illegible] turnips alone. The manage- [illegible] n this case was in every respect [illegible] for lot 1st, with the exception [illegible] of cake consumed, which [illegible] 4 lbs. per sheep, being at the [illegible] oz. per day to each, an allow- [illegible] as found they would not exceed. [illegible] January, when the experiment [illegible] ir respective weights were—D [illegible] and F 2,031 lbs. On the 15th [illegible] having finished its portion, [illegible] lbs., and on the 2nd March, [illegible] ng also finished theirs, weighed [illegible] and E 2,274 lbs. The two cake [illegible] ch lot consuming the same quan-

[illegible] OF THE IMPROVEMENT MADE BY DIFFERENT DIVISIONS.

[illegible]	Weight at first.	Weight at last.	Increase	Increase from cake.	Wt. of cake consumed.	Cost of production per lb.
	lbs.	lbs.	lbs.	lbs.	lbs.	oz.
[illegible]	2763	3054	286	209	1182	66
[illegible]	2739	2966	227	150	1182	83½
[illegible]	2803	2880	77	..	..	..
[illegible]	2082	2315	223	167	880	60¼
[illegible]	2001	2274	273	207	880	51¼
[illegible]	2031	2097	66	..	..	..

[illegible] observed from the foregoing table, [illegible] rovement made by C and F is [illegible] rage; this, however, would have [illegible] ed by any person having the [illegible] ce in the management of sheep, [illegible] ar manner it was necessary to [illegible] for the purpose of ascertaining [illegible] the cake as a manure upon the [illegible] ndeed, the treatment altogether [illegible] y unfavourable to sheep; but as [illegible] laboured under the same disad- [illegible] management does not therefore [illegible] e least from the value of the ex- [illegible] will be noticed, also, that the [illegible] made by A and D on the home- [illegible] and E on the foreign, is exactly [illegible] e different fields, a circumstance [illegible] in any way be accounted for.

[illegible] rt of this experiment now falls [illegible] d, viz., the value of linseed-cake [illegible] when consumed upon the ground [illegible] produce of one field only being

given, though the effect produced upon the two cake divisions in the other, presented an equally marked and favourable appearance.

Early in March, the land was sown with wheat, reaped by the 20th of September, and thrashed on the 21st December, when the produce of the different divisions was found to be as follows, the grain being all properly cleaned of refuse, but not separated into first and second quality :—

TABULAR VIEW OF THE PRODUCE OF THE DIFFERENT LOTS.

Lot.	Quality of land in acres.	Weight of grain.	Weight per bush.	Increase of grain from cake.	Weight of straw.	Increase of straw from cake.	Wt. of cake consumed.
		lbs.	lbs.	lbs.	lbs	lbs.	lbs.
A	1.041	2248	61¼	288	3723	817	1182
B	1.041	2323	61⅝	263	3506	600	1182
C	1.041	1960	62½	..	2906	..	..

EXPERIMENT II.

This was an experiment carried on during the latter part of 1844, for the purpose of ascertaining the relative value of the following articles in the fattening of sheep, viz., linseed, linseed-cake, poppy-cake, beans, and a mixture of beans and linseed. The sheep selected for this purpose consisted of 95 Cheviot ewes, taken from a flock of 250, which had reared their lambs during the summer, and were of fair quality when the experiment commenced, but from the greater part of them wanting teeth, and, consequently, unable to break the turnips, they were supplied instead with a full allowance of turnip-tops (except for a few days afterwards specified), in addition to the different articles used, a circumstance which tends to enhance the value of the experiment, as, from the worthless nature of turnip-tops in fattening, any improvement made by the animals must be almost entirely attributed to the qualities of the foreign substances used.

The different lots, which consisted of four of 20 and one of 15 sheep, may be classed as A, B, C, D, and E. Lot A, containing the 15, were put upon the linseed, having reduced the number as much as was consistent with accuracy for the experiment, from an apprehension that linseed would not tend to improve the animals, on account of the large quantity of oil it contains acting too powerfully upon their systems; a fear, however, which had no foundation, as they kept throughout in as healthy and natural a state as if feeding upon grass. Lot B was put upon the linseed cake, and received the same quantity as D upon the beans; C was put upon a mixture of beans and linseed for the first three weeks, and afterwards upon the poppy-cake, and E upon a mixture of beans and linseed. All the several lots being enclosed upon small portions of grass land equally sheltered, had as impartial justice done them in the management as it was possible to effect. The quantity given at first of the different articles was smaller than indicated by the average consumption, and was gradually increased to as much as each division would freely consume. The time, also, which this experiment was carried on, was limited to what was considered the most proper for getting the greatest return from the articles used. The results are as follow :—

Lots	Weighed 21st Oct	Weighed 12th Nov.	Increase.	Weighed 23rd Dec.	Increase.	Average consumption by each sheep per week.	Average improvement of each sheep pr week.	Cost of production, per lb.	Total Consumption.
	lbs.	lbs.	lbs.	lbs.	lbs.	oz.	oz.	oz.	lbs.
A	1,839	..	..	2 008	169	8 6¼ Linseed	20	40¼ Linseed*	477 Linseed.
	..	..	..	..	..	4¼ Beans	..	..	36 Beans.
B	2,401	..	..	2 603	202	11 3¾ Linseed cake..	18	101 Linseed cake	1275 Linseed cake.
C	2,383	2,479	97	..	..	9 6¼ Beans and Linseed.	23⅜	59 Beans and Linseed..	{ 310 Beans. 48 Linseed.
								106 Poppy-cake.....	1180 Poppy-cake.
D	2,404	..	..	2,557	178	15 7¼ Poppy-cake	23⅜	133¾ Beans	1275 Beans.
						11 3¼ Beans	13¼		702 Beans.
E	2,417	..	..	2 736	319	100 Beans and Linseed.	28¼	56¼ Beans and Linseed	{ 432 Linseed.

* In calculating the cost of production per lb. of division A, 5lbs. have been deducted for the 36lbs. beans consumed, these having been given to the sheep to induce them to eat the linseed, which had acquired a musty smell from lying in a ground state.

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bserved from this table, that the rnips effected in division B, is ems a larger proportion for the linseed-cake, than Experiment quantities: but much, no doubt, pon the size and condition of e lower the condition, the greater ntity of food consumed. It may afe calculation, that 16 ounces d-cake per day to sheep of nine will effect a saving in the con- urnips equal to 33 per cent., and time so far improve the health ls as to diminish the number of ards of 50 per cent.

EXPERIMENT IV.

ascertain if the use of the differ- Experiment II., produced any to tallow, five average ewes from each division and weighed; terwards they were killed and r the inspection of the reporter, riven in the interval, 23 miles. g table exhibits the results:—

weight c. 28.	Weight of Carcass, Dec. 25.	Weight of Tallow.	Weight of Skins.
lbs.	lbs.	lbs	lbs.
666	344	55	52
647	335	57	57
654	338	57	57
641	327	49	52
688	347	61	50

periments having been conducted o personal information, a strict curacy was observed in every de- ough conducted upon rather a li- they clearly establish the fact, that be produced at a lower rate per beral use of artificial keep along than upon turnips alone, taking increased value of the manure and that of the different articles riment II., linseed is the most beans the least so, but that a th forms a useful and nutritious d.

MANUFACTURE OF GAS ILLUMINATION FROM *

BY M. JOBARD.

quantity of carburetted hydro- able for illuminating purposes, uced by the distillation of coal, matters, and oils; but at the considerable quantity of hydro- hydrogen is produced in the naphthaline, paraphine, pyroge- c., which are deposited in the ther in a liquid or solid form.

du Musée d'Industrie, and *ndon Journal.*

Now, these substances, which are rendered useless and injurious to the manufacture of the gas, by the present mode of operating, are precisely those which are the most rich in illuminating properties. It has, therefore, been proposed to dissolve these hydrocarburets in hydrogen gas possessing no illuminating properties, and thereby rendering it capable of affording light, as the carbon is the source of the illuminating power. The whole of the year 1833, was devoted to experiments for this purpose, and to the production of apparatus for charging with carbon the hydrogen gas produced by Dobereiner's lamp.

These experiments were successful beyond expectation, and the result was laid before the Royal Academy of Brussels, upon which they appointed a commission to inquire into it, by whom the following report was presented in the sitting of 4th January, 1834 :—

"The commission appointed at the last meeting, to examine the effect of the lamp constructed by M. Jobard, now presents its report, from which it appears that the commissioners are convinced that the gas burnt with a very white and brilliant flame (equal to 36 candles of six to the pound), and that, being desirous of ascertaining its illuminating power, by a comparison of the shadows, they find that the light of this gas, issuing from a 12-hole Argand burner, is at least double that of the coal-gas furnished by the Brussels Gas Company when burnt in a 12-hole Argand burner, pierced with holes three times the size, which are employed for lighting most of the shops in this town. These observations appear completely to answer the questions put by M. Jobard to the Royal Academy.

"In order fully to appreciate his invention, it should be worked on a large scale, and an account kept of the economy effected, which he could not communicate to us without making us acquainted with his mode of operating, and which he wishes to keep secret."

The commission being desirous of seeing this invention worked on a larger scale, I had a gasometer constructed, and burners placed in every apartment in my house; a single burner was sufficient to light the largest room brilliantly, and a saving of several centimes was effected for each burner: this resulted from sulphate of iron being produced during the operation. The gas was charged with carbonaceous vapours by passing it through a cylinder containing about two quarts of oil of gas-tar, which was not exhausted at the expiration of eight days, during which time the experiments were continued. I think it right to enter into all these details for the benefit of those persons who might feel desirous of taking up this invention, which is on the eve of becoming public property.

Some doubt still remained as to whether the gas would retain the illuminating power after being confined in gasometers and traversing a considerable length of pipe; it appeared to me that very likely, in wiptertime, the carbon mechanically combined with the gas, might become disengaged and deposited.*

The following fact, contained in Thénard's Treatise on Chemistry, was sufficient to put me in the right path:—*Gasses combine at the moment of formation.*

A brevet was taken by me in Belgium for the production of hydrogen gas, by the decomposition of steam in vertical retorts, filled with incandescent coke, and for uniting this gas *at the moment of formation*, with hyper-carburetted gas produced by the distillation of fixed oils, or any other hydrocarburets. I afterwards went to Paris, where, by deed, I gave up my invention to Messrs. Selligue and Tripier, in consideration of the sum of 10,000 francs and a third of the profits, on condition that M. Selligue should pass as the inventor; and as such he received the large gold medals from the Society of Encouragement and the Academy of Industry. He was about to receive the gold medal at the exhibition of 1839, and also the Cross of the Legion of Honor, for what Baron Thénard called this splendid invention, when I was summoned before a jury to declare the truth.

It was useless to dissemble before a jury composed of such men as Baron Thénard, Gay-Lussac, Brongniart, Darcet, Dumas, Payen, &c. I simply showed my Belgic brevet, our agreement, and M. Selligue's receipt. The case was not long in being decided; the Selligue gas, and also the Selligue system of sinking wells, which I had given up to him by the same agreement, were both deprived of their false name at once.

M. Selligue has, however, contributed his mite, for he constructed several horizontal furnaces, which would not work, before he adopted my vertical plan, and which worked successfully at Antwerp, the description of which will be given hereafter.

The towns of Dijon and Strasburg, and two of the faubourgs of Lyons and Paris had

*This was the case in winter time at St. Vallier, near St. Etienne, in the manufactory of Messrs. Chareten and Son, lighted by 240 burners.

been for some time lighted with this gas, which, after being opposed for some time by powerful continental gas companies, was on the point of sinking into oblivion, when it was taken up in Dublin, and even in London.* It was with great pleasure I saw it come into use in that country, abounding with coal, as I thought it would only be used in those countries where coal is scarce and dear; a plan was then adopted in Paris, which I had previously proposed, and which consisted in causing gas obtained by the decomposition of water, to take up hydrocarburets produced by the distillation of coal gas, at the moment of its formation. Twice or thrice the quantity of illuminating gas could be obtained by this means than by the ordinary method. The illuminating power of ordinary gas might also be easily doubled by passing it through a vessel filled with carburets of hydrogen, slightly heated, as described in my brevet.

By combining pure hydrogen gas, at the moment of formation, with coal gas, charged with an excess of carbon, the necessity of purifying it is done away with, as the ammonia and sulphurets of hydrogen liberated are dissipated and lose their intensity; but by employing oil of schistus, or fish or other oil, any purification would be unnecessary: this is, therefore, another advantage.

Being desirous of making the public acquainted with the advantages of this new system, and not having any further interest in the matter, I think it right to state the reasons which were given in opposition to it, by publishing the report read by M. Arago, at a meeting of the Academy of Sciences, December 3rd, 1838.

I will also refer to the Bulletin of the Society of Encouragement of the same year, for the report of Messrs. Dumas and Payen, in consequence of which, one of the grand prizes of the Society was granted to M. Selligue.

In the following year a patent was taken in England, in the name of M. de Val Marino. About the same time this invention found its way into Austria, and fell into the hands of M. Offenheim, by whom it was offered for sale in Belgium to the inventor himself, with whom M. Offenheim was not acquainted.

To return to the explanations presented to the Academy of Sciences—there are as follows:—

Hydrogen gas is charged with carbon by passing it through a hollow cylinder, *heated to redness*, where it meets with highly carburetted oils. A chemical combination, and not merely a mixture, then takes place, as is proved by the analysis of M. Peligot, Professor at the Polytechnic School, which was as follows:—

Carburets of hydrogen.....	57
Oxide of carbon	28
Free hydrogen	15
	100

The theoretical question of illumination is therefore as follows:—

"*What is the process which will produce the largest quantity of light from* 1 *lb, of either oil, resinous matter, schistus, or coal-tar?*

"One pound of oil of resin or schistus produces in the new apparatus 35 cubic feet of gas, 3 feet of which are burnt in an hour in a burner giving a light equal to ten candles, which is equal to 23 hours' light. Now at Belleville, Antwerp, Frankfort, and wherever gas has been manufactured from oil of resin, and from pure resin, the average quantity produced was from 7 to 9 feet for every pound of oil, but in three or four days it fell to from 6 or 8 feet. Separate experiments with new retorts may furnish from 12 to 13 feet, and the production of this quantity has been announced by M. Tailleberg as a grand discovery. Let us take this quantity, although it is nearly double the average;—two feet and a half of this gas must be burnt per hour to furnish a light equal to ten candles, according to a report upon the lighting of the town of Antwerp in October, 1837, with resin gas, and in October 1838, with gas made from water. Let us only reckon 2½ feet; 1 lb. of oil therefore furnishes 6½ hours' light, and admitting 17 feet for every pound to be the product, which cannot be obtained without the addition of water, it would even then only give 15 hours' light, whilst the water-gas furnishes 23."

But there are other facts which can be proved without dispute. The production of gas from water does not stop at 35 feet per pound. By augmenting the quantity of water, with respect to the oil in the apparatus, the gas becomes weaker and weaker, until its density approaches and even exceeds that of coal gas. In experiments made with more than 1,500 cubic feet, and watched for several consecutive hours, the rate of production was 111 feet of gas for every pound of fish-oil (oil of schistus producing exactly the same result.)

It was only necessary to burn 6 feet of

* Gas made from water was used in Dublin, by Mr. Kelly, of Upper Gloucester-street; in London, by Mr. Stones, of 25, Golden-square; and under the arches of Waterloo-bridge.

this gas in order to produce a light equal to ten candles, which was but in a very slight degree less brilliant than coal gas. Gas produced at the rate of 55 feet per pound of oil of schistus gave a consumption of 4 feet in the same burner. Thus, supposing the water gas to be produced at the rate of 80 feet to the pound, it is equal in power to the coal gas, and burns but 5 feet per hour. One pound of oil will therefore give 20 hours' light. Let us reckon the cost of this illumination with oil of schistus, which only costs about 2s. for every 100 lbs., and a consumption of combustibles which is diminished in proportion to the quantity of gas produced and the size of the apparatus; whilst, on the contrary, with resin gas, as the decomposition of the gas takes place on the surface of the metal, the small retorts are the most advantageous; and, at the same time, the mass of gas produced is not augmented, but simply its volume, and this only by decarburetting the richest portion of the carburets of hydrogen by the action of a higher temperature.

The indefinite augmentation of the light obtained from the water gas, in proportion as it is produced weaker or stronger, tends to prove that the presence of oxide of carbon augments the illuminating power of gas, no doubt augmenting at the same time the quantity of heat developed during combustion.

I shall not, therefore, be accused of exaggeration when I state, that there is some value in a process, the principle of which is to decompose water, a substance of no value, by means of coke, which is of very little value,—as under this process 1 lb. of oil, which costs a halfpenny, will supply a burner giving a light equal to ten candles, during twenty hours.

IMPROVED MODE OF TREATING GUANO, FOR THE PURPOSE OF OBTAINING CHEMICAL COMPOUNDS THEREFROM.*

BY WILTON GEORGE TURNER.

This invention consists in the improved modes of treating guano, so as to produce oxalic acid therefrom, without rendering it less applicable for the production of certain other chemical compounds, for the manufacture of which it has heretofore been used.

Now, the purposes to which guano has hitherto been applied in the manufacture of chemical compounds, have been confined to the production of ammonia, and certain compounds of cyanogen. The principle, if not the only source of these substances in the guano, is the uric acid which it contains, and they have been derived from the uric acid either by the destructive distillation of the guano, or by its combustion in fused potash. This is effected by acting on the uric acid of the guano with peroxide of lead or manganese, suspended in water at a boiling temperature, by which means it is well known that it will be decomposed into oxalic acid, allantoin, and urea. The former of these forms an insoluble compound with the lead of manganese, and is thus separated from the allantoin and urea, and as the two last contain all the nitrogen originally existing in the uric acid, this production of oxalic acid is not attended with any loss of the nitrogen compounds.

Guano imported into this country may be divided into two classes: the one containing the products of the urine of birds in a perfect condition; the other, characterised by the presence of various products not originally existing in the urine, but arising from after-chemical changes. These classes of guano may readily be distinguished by the action of cold water; if the guano belong to the first class, the solution thus formed, like all fresh urine, will have an acid reaction on test paper; whereas, it will have an alkaline reaction on test paper if it be of the second class.

Guano of the first class should first be reduced to powder by pounding, and steeped and washed in cold water. This will remove the soluble urine salts, consisting of sulphates and muriates of soda and potash, and the superphosphates of lime, which may be recovered by boiling to dryness, and will form valuable manures. The insoluble residue remaining after the washing should now be digested in a strong cold solution of carbonate of soda or potash, to free the guano, as much as possible, from colouring matter. The insoluble residue now consists of urate of ammonia and bone earth, and may be at once treated with dilute sulphuric acid, which will liberate the uric acid, and bring it into a fit condition to be acted on by peroxide of lead; which is done by boiling the residue in a dilute solution of soda, or its carbonate, by which a solution of urate of soda is obtained; care should be taken that a large excess of soda is not used in this process, although it is equally important to have enough to decompose the whole of the urate of ammonia of the guano; 168 lbs. of uric acid will require 31 lbs. of soda. The urate of soda is only sparingly soluble in cold water, the solution must be therefore separated from the earthy residue as hot as

* *Medical Times.*

possible, and the latter carefully washed with boiling water till freed of urate of soda. The weak solutions may be kept to use in the next operation. The strong solutions, however, which, on cooling, would deposit urate of soda, are to be treated with a second quantity of carbonate of soda, equal in amount to the first, and then evaporated till a deposit is observed. On cooling, the whole forms a confused crystalline mass, from which the liquor must be drained and pressed, and the solid residuum washed with cold water. The urate of soda obtained by this process is of a pale straw colour, even from guano of the second class of a very dark colour, and this is a point of great importance, as influencing the colour of the oxalic acid produced.

The urate of soda is now added to a boiling solution of sulphuric or muriatic acid, in such excess as to ensure a perfect separation of the soda, and the ebullition should be maintained for a quarter of an hour.

The uric acid thus obtained, after being carefully washed with cold water, to free it from all adhering acid, is next to be boiled with pure peroxide of lead.

The process of boiling with peroxide of lead should be conducted in the following manner:—A known weight of the uric acid should be placed in an open cylindrical iron vessel capable of holding two gallons of water for every pound of the acid, and fitted to boil by steam. Clear saturated solution of lime water is then added, and as soon as it is heated and in brisk ebullition the peroxide of lead should be added in successive portions, as long as it is observed to be whitened by the boiling liquid.

If the materials be quite pure, 168 lbs. of uric acid will whiten 240 lbs. of peroxide of lead, and in practice the above numbers will serve as a close guide. It is essential, that care be taken not to use an excess of the peroxide of lead, for reasons hereafter to be explained.

The whitish powder thus obtained is oxalate of lead. The supernatant liquor should be drawn off, and the residuum washed with clean water; when the residuum is thus clean it should be put into a leaden vessel and boiled with muriatic acid, diluted with about its own weight in water, 200 lbs. of acid of sp. gr. 1·179, should be used for every 240 lbs. of peroxide of lead, which has been converted into oxalate of lead.

The last-mentioned liquid now contains oxalic acid, which is readily obtained in its solid form by evaporation and crystallisation, but it should be first treated with dilute sulphuric acid, added in small quantities as long as a precipitate is formed. The insoluble part is now muriate of lead, and should be collected, after carefully washing it, to be reconverted into peroxide of lead by processes explained hereafter.

The allantoin should be introduced into a still with a solution of any caustic alkali or alkaline earth, such as lime suspended in water of a solution of baryta.

By boiling, the allantoin is decomposed of the caustic alkali into oxalic acid and ammonia. The former unites with the alkali used, while the ammonia passes over, and may be collected as liquor ammoniæ; the oxalic acid thus generated may be obtained as oxalate of potash, if potash had been the alkali used, or as oxalic acid if baryta had been employed, by decomposing the latter oxalate by means of sulphuric acid; 50 lbs. of oil of vitriol are required to decompose 122 lbs. of oxalate of baryta, and the process conducted as before described for oxalate of lead. The urea, which has been brought to the consistence of a syrup, may be used either for the manufacture of ammonia, or of compounds of cyanogen, or partly applied to both purposes. Ammonia is obtained by boiling it with milk of lime, in a still, when it is decomposed into carbonic acid, which unites with the lime, and into ammonia, which passes into the receiver. If required for the purpose of compounds of cyanogen, it should be brought to perfect dryness in a water bath, and mixed with coal tar, or other carbonaceous bodies, being treated as guano in processes now well known, or the dry urea may be exposed to a heat of 250 degrees in a retort. At this heat it fuses, boils, and is decomposed into ammonia, which passes off, and may be condensed, by a suitable apparatus, and into cyanuric acid, which remains as a solid in the retort; this latter may readily be converted into cyanide of potassium, being added to fused carbonate of potash, charged with carbonaceous matter, and thus be converted into ferrocyanide of potassium by processes now well known.

For converting uric acid into allantoin, oxalic acid and urea, attention is required—first, that the uric acid be perfectly free from any adhering sulphuric or muriatic acid; secondly that the peroxide of lead be also perfectly free either from acid or chlorine, and be used in the state of an impalpable powder; and thirdly, that no excess of the peroxide be used.

To ensure the necessary freedom from acid, in the case of the uric acid, the urate of soda should be decomposed by muriatic acid, and the uric acid then exposed to a steam-heat till perfectly dry.

It is advisable, however, that the manufacturer should prepare a certain portion of pure uric acid and peroxide of lead, as standards by which to test each batch of uric acid, and peroxide of lead, before he uses them on the large scale, as otherwise serious losses may result.

The before-described process has been modified to obtain this ready-formed oxalic acid. The latter exists in the guano, partly in combination with ammonia, and partly in combination with lime. The oxalate of ammonia is taken up by the cold water in which the guano is first digested, and may be precipitated from the urine salts by any salt of lime or baryta, the cheapest of which is the sulphuret of barium; and from the oxalate of baryta the oxalic acid may be obtained by decomposing with sulphuric acid; the oxalic acid thus produced is of a very dark colour.

This insoluble portion is now boiled, as before described, in a dilute solution of carbonate of soda. This not only forms urate of soda, but also oxalate of soda. The whole is left to cool before drawing off the liquor, by which most of the urate of soda is deposited. The solution is now evaporated when urate of soda, and then oxalate of soda (which is also a sparingly soluble salt), is deposited, and the oxalate of soda thus obtained rendered colourless by washing with a cold solution of carbonate of soda, and subsequently crystallisation. Pure oxalic acid may then be obtained from it by precipitating the oxalic acid by means of sulphuret of barium, and then decomposing by sulphuric acid, as before described.

The patentee proceeds to describe the process by which he reconverts the muriate or sulphate of lead into peroxide, so as to bring it back into a fit condition to be again used for the conversion of uric acid into oxalic acid. Muriate of lead, contains a little sulphate, having used first muriatic acid, and then a little sulphuric acid, to complete the decomposition of the oxalate of lead. The apparatus required will be an ordinary chlorine still attached to a Woulffe's apparatus, consisting of at least two vessels, each capable of holding twenty pounds of water to every pound of muriate of lead, to be operated on and fitted with a stirring apparatus. Each vessel is now charged with prepared milk of lime, containing one part of lime to forty of water, and with the muriate of lead to be acted on. The quantities will be one part of lime to two of muriate of lead.

The apparatus being thus arranged, the chlorine still is charged; and the chlorine gas generated, passing into the Woulffe's vessel, is readily absorbed by the milk of lime and muriate of lead, which, however, should be kept from settling to the bottom of the vessel by the stirring apparatus.

The generation of chlorine should be continued until it is found to pass through the first Woulffe's vessel without further absorption. This indicates that the changes are complete in that vessel. The whole contents should, therefore, be removed, and be replaced by a new charge of muriate of lead and milk of lime. The chlorine may now again be generated, but the stream of gas should be made to pass first into the second Woulffe's vessel; and thus the two are worked off alternately. In this way the muriate of lead is converted into peroxide, while the milk of lime is now a solution of chloride of calcium, of chloride of lime (or bleaching powder), and of chlorine. This solution of bleaching liquor is withdrawn from the peroxide of lead, and treated with muriate of lead till it loses its smell of chlorine. It acts like the chlorine gas itself in converting muriate of lead into peroxide, and therefore assists the change which is afterwards to be completed in the Woulffe's apparatus. The peroxide of lead, which is there produced, should be washed repeatedly with boiling water till it becomes tasteless; it should then be boiled in a very dilute solution of soda, and again washed until tasteless. It is now in a fit condition for use, and should be kept covered with water to preserve it.

To obtain a supply of peroxide in the first instance any of the known methods may be adopted. The brown acetate of lead, treating it first with chlorine in Woulffe's apparatus, by which the acetic acid is liberated and the lead converted into a mixture of peroxide and chloride of lead, and the change completed by milk of lime and chlorine is the most economical. The claim is for the improved mode of treating guano by boiling the uric acid obtained from it with peroxide of lead or peroxide of manganese in water or lime water, and thus producing oxalate of lead, allantoin. and urea; whereby oxalic acid is manufactured from guano, without losing the nitrogen compounds hitherto obtained from it.

A METHOD OF SEPARATING AND EXTRACTING THE GREASE, OR OIL, AND OLEAGINOUS MATTER FROM WATER, &c.*

BY JOHN HENRY SHEARMAN.

THIS invention consists in a mode of extracting the grease, oil, or oleaginous or sapona-

* *Newton's London Journal.*

ceous matter from water containing the same, particularly the water which has been employed for cleansing wool, spun wool, and woollen cloth.

The water to be operated on is introduced into a large cistern, and the patentee then proceeds to neutralise the alkali contained in the oleaginous or saponaceous matter of the water, by the use of one or more of the acids capable of effecting this object (such as sulphuric acid), according as the bases of the soap and the calcareous matter contained in the water varies: it will sometimes be necessary to employ several acids, one after the other. By the action of the acids upon the alkali, a scum, having the appearance of mud, rises on the surface of the water, and is carefully removed therefrom with a large skimmer, and put into a leaden cauldron, or other vessel not injuriously acted upon by the acid, which vessel is to be heated by steam or otherwise. The scum is heated to 80° Reaum., or 212° F., and treated with muriatic acid, more or less diluted; the liquid still contained in the scum is allowed to subside to the bottom of the cauldron, from whence it is drawn off by a tap or pump; the residue is boiled for several hours, and the oil which then appears on the surface is taken off, from time to time, by means of a large copper shovel; when the oil ceases to appear, the residue is submitted to the action of a powerful press, to extract the remaining oil. The oil or grease, thus obtained, is in an acid state (being either stearic, margaric, or oleic acid, or a mixture of them), and is to be put into a copper cauldron, and heated to 60° or 70° Reaum.; powdered chalk is then mixed with the oil or grease, in order to neutralise all acidity as far as possible; which neutralisation is to be finished by the addition of zinc, either in the state of shavings, filings, or fine powder. This mixture is to be stirred for thirty minutes, and the heat gradually increased during this time to the boiling point of water; it is then allowed to rest for a few minutes, and boiling water, to the amount of one-tenth of the volume of the oil, is poured upon the mass, which is now stirred for twenty minutes, and left to rest for about two days: a small degree of heat being maintained to facilitate the precipitation of the water and other matters. At the expiration of the two days, the oil or grease is drawn off, and is ready for use.

The patentee claims, as his invention, the operating on water containing grease, oil, oleaginous or saponaceous matter, for the purpose of extracting such grease, oil, oleaginous or saponaceous matter, therefrom, as above described.

IMPROVEMENTS IN DISSOLVING LAC AND SHELLAC, AND IN RENDERING FABRICS WATER-PROOF.*

BY ALPHONSE LE MIRE DE NORMANDY.

THE first part of this invention refers to two methods of dissolving lac.

According to one method, the shellac, seed-lac, stick-lac, or any other form of lac required to be operated upon, is first dissolved in an aqueous solution of alkali, by adding to every cwt. of lac, in a suitable vessel, 112 gallons of water, in which about 40 or 42 lbs. of soda-ash have been or now are to be dissolved, and then causing the contents of the vessel to boil, by means of a fire beneath, until the lac is dissolved:—the patentee prefers to use soda-ash, on account of its cheapness; but other alkalies may be employed. After the lac has been dissolved, the solution is filtered through a coarse cloth, to separate any impurities; and then a quantity of sulphuric acid (but nitric, muriatic, oxalic, or other acids may be used), rather larger than is strictly necessary to saturate the alkali employed, being added, the lac becomes separated from the solution in the shape of a semi-viscid or soft plastic mass. This mass may be melted over a fire or otherwise, and afterwards spread upon any surface required to be waterproofed, or used for other purposes, such as cementing together pieces of wood, stone, metal, or fabrics.

The second method consists in pouring upon shellac, seed-lac, stick-lac, or any other form of lac, a certain quantity of that oil which passes over during the distillation of spirit of wine, obtained from corn or potatoes, and known under the name of grain or potato oil (the fusel oil of Germany, and termed the hydrate of protoxide of ormyle by the chemists), by means of which the lac is entirely dissolved. The quantity of oil used depends upon the degree of liquidity desired. The second part of this invention consists in rendering fabrics waterproof by the application of a solution prepared by melting the plastic mass, before-mentioned, alone, or dissolving it in the grain or potato oil, or by dissolving the lac, without any previous preparation, in the oil, as described under the second method; but the patentee prefers to use the plastic mass on account of its greater pliancy or suppleness. The plastic mass is also perfectly soluble in alcohol and naphtha.

The patentee does not claim the dissolving of lac in alkali, and applying it in that state; but he claims, as his invention, treating the

* *Newton's London Journal.*

alkaline solution of lac with sulphuric acid, or other acids, so as to obtain the lac in a solid, semi-solid, or viscid form, from the said solution; also, the use of the potato or grain oil, called hydrate of protoxide of ormyle, for the purpose of dissolving lac or shellac, or the lac obtained by the action of sulphuric acid upon the alkaline solution, as above described; and likewise covering fabrics with the lac obtained by the processes above described, for the purpose of rendering them waterproof.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

DISAPPOINTMENTS IN MEDICINE FROM A DISREGARD OF CHEMISTRY; WITH REMARKS ON THE USE OF NAPHTHA IN PHTHISIS.*

BY PHILIP H. HARPER, ESQ., M.R.C.S.

One of the principal reasons why many remedies which have been vaunted by their discoverers as nearly infallible means of cure for certain diseases, but which have, upon trial by unbiassed men, been found wanting, has been the great confusion of names applied to many chemical preparations, so that, in reality, the same remedy has in many instances never been tried by any but the discoverers.

The ignorance of many eminent men of the present day of anything beyond the mere rudiments of chemistry, however lamentable, few will dispute. Although men, generally, are becoming aware of this, and are rousing themselves to remove the stigma, we have many examples of men whose days of studentship, in the common acceptation of the term, have long passed away, again donning the laboratory apron, labouring hard, in self-defence, to keep the lead of their juniors, and allowing wonder-working chemistry to assist and remodel their antiquated ideas.

One class of men who ought especially to strive to avoid the quicksands upon which so many valuable remedies have foundered, consists of those who propose remedies for hitherto supposed incurable diseases. Unfortunately, these oftentimes are the very men who exert themselves the least, thinking, perhaps, that their "reputation" will carry them through. The disappointed practitioner, however, trying their remedy without success, from the mere misapplication of names, instead of the discoverer using the proper scientific term. How is it that we have so many and such contradictory accounts as to the efficacy of naphtha in phthisis. In many cases it may have afforded great amelioration, while in other cases, similarly characterised as to stage and progress, it has failed in affording even temporary relief.

Dr. Hastings naturally, when he announced the so-called curability of phthisis by naphtha, induced many able practitioners to try it; and when their reports were neither so satisfactory nor so sanguine as he wished, he looked about for some plausible excuse for the failure, and at last hit upon the fact of their being many kinds of naphtha in the market, alleging the use of a wrong article in the failures.

But why has Dr. Hastings confounded names?—why applied the term "naphtha" to a substance which has nothing to do with it—viz., acetone? True it is, that acetone sometimes occurs mixed up with naphtha, but only as an impurity. The term, pyroacetic spirit, or naphtha, is only applied by chemists to the hydrate of the oxide of methule, $C^2\ H^3\ O$, aq. The formula for acetone is $C^3\ H^3\ O$.

Certainly, he mentions a means of preparing the substance he intends to be used; but why fly in the face of chemistry, and call it naphtha?

Practitioners have taken for granted that any substance that goes by the name of pyroacetic spirit was to be used. Curiously enough, for once, it was better to use an impure substance than a pure one. Those men whose druggists have supplied them with an impure mixture (wood spirit, pyroacetic spirit) may have succeeded, because of the large quantity of acetone which is mixed up with it, whilst others, whose druggists were honest men, failed, because they used a pure article containing not a trace of acetone.

The tests he gives for the article he intended to be used are no criterion. Hydrate of the oxide of methule, and acetone, are both, when pure, miscible with water, without the production of milkiness; both are neutral to test paper; and both effervesce with pure nitric acid, without change of

* *Lancet.*

colour of the solution itself, although the products of the decomposition are very different, those of the decomposition of acetone being a series of new compounds, while those of the decomposition of the hydrate of the oxide of methule are water and oxalic acid.

The tests for the two substances which appear to be the most worthy of reliance seems to be the taste, which certainly is very different, that of acetone being pungent, very much like peppermint, and really not very disagreeable; while hydrate of the oxide of methule has a very nauseous, biting taste. Their reaction, also, with chloride of calcium is very characteristic; hydrate of oxide of methule, mixed with it, forms a definite compound; (Me O, aq.) + Ca Cl, in beautiful crystals. So powerful, indeed, is the attraction of the two substances, that the temperature of the solution rises considerably during the formation: acetone forms no such compound.

Some practitioners may, perhaps, think that there is really not so much difference between the formula of the two substances; but if they be not satisfied with the difference in action shown by the reaction mentioned above, I would remind them that there is as much difference, or even more, than there is between many substances whose actions upon the animal economy are much more marked.

Look, for instance, at the formula for atropia—C^{34} N H^{23} O^6, and pipe-rine—C^{34} NH^{16} O^6; or between turpentine—C^{20} H^{16}, and camphor—C^{20} H^6 O^2; to say nothing of the chloride and bichloride of mercury.

My object in these remarks, is to call attention to a serious and frequent cause of disappointment, the effect of inadvertency, caused by indifference to the new facts revealed by chemical science.

ON STARCH, ARROWROOT, AND SAGO.*

BY M. MAYET.

For a long time starch was considered as an unorganised product, or, as an immediate principle, analogous to sugar or gum, completely insoluble in cold water, but soluble in boiling water, with which it forms, on cooling, a gelatinous mass. Yet in the year 1796, Leeuwenhoeck ascertaining, by the aid of a microscope, that starch was an organised body, of a globular form, consisting of an exterior coat, resisting the action of water, and sometimes the digestive functions of animals, and of an interior substance readily soluble in water, and easy of digestion. But these observations were entirely forgotten, until, in 1825, M. Raspail again stated that each grain of starch is an organised body, consisting of an envelope or integument, unacted upon by cold water, becoming permanently coloured by iodine, and of an interior matter soluble in cold water, and also coloured blue by iodine, but readily losing this property by the action of heat or air, from which M. Raspail concluded that the property of being coloured blue by iodine was due to some volatile substance.

A paper by M. Caventou, in which this chemist seems indisposed to admit the results obtained by M. Raspail, having induced me to occupy myself with this subject, I made a number of experiments, which, although confirming the statement of the organisation of the grains of starch, disproved all the other assertions of M. Raspail. Thus, while unbroken potato starch, examined in water, under the microscope, presents the appearance of transparent grains, all entire, the broken starch put into water, forms rapid currents, due to the emission and solution of the soluble interior matter of the broken grains. A part of this matter disappears entirely; another remains attached to the grains in the form of a jelly, and disappears on the application of a gentle heat. The broken integuments which form the envelopes of the grains of fecula, are then easily perceived.

But, with the exception of this result, which is confirmatory of the organised structure of the grains of starch, all the others tended to show that the three observed parts, namely, the *tegument*, the *gelatini-form* and the *soluble matter*, were but one and the same substance, producing the same reactions with iodine, the acids, the alkalies, nut-galls, and metallic solutions, and that these three parts differed only in the form which organisation had given them. Such was the conclusion to which I was brought by numerous considerations, some of which have since been confirmed.

M. Guerin-Varry, nevertheless, after having, in common with myself, distinguished three parts in starch, regarded these parts as three distinct substances, of different elementary composition; but these results were contradicted by MM. Payen and Persoz, who, after having distinguished three different principles in the only soluble matter, afterwards admitted that, with the exception of an exceedingly thin integument not colourable by iodine, all the rest consisted of one and the same principle, to which they gave the name of *amidone*. Finally, M. Payen, in a

* *Journal de Pharmacie*, and *Pharmaceutical Journal*.

subsequent memoir, published in 1838 (*Annales des Sciences Naturelles Botaniques*, t. x., pp. 5, 65, *et* 161), where a *résumé* will be found of all the investigations which have been undertaken on the subject of starch, and of which a great part was his own, has definitively fixed the opinion of chemists as to the constitution of starch, in regarding it as an organised body, but of a uniform nature and composition, represented by the formula $C^{12} H^{10} O^{10}$, a composition resembling that of cellulose, gum arabic, and anhydrous sugar. This conclusion, with the exception of the elementary composition, to which I have not directed my attention, corresponds with what I published in 1829; but there exists, notwithstanding, an essential difference in our results. I stated that potato starch consisted of an integumentary insoluble substance, and of an interior soluble substance, both colourable by iodine. M. Payen now thinks that this starch is organised and solid to the centre, and does not contain any part soluble in cold water. I founded my opinion on the fact that the starch bruised, not only dry but in water, and without any elevation of temperature being occasioned by rubbing, partly dissolved in water, and of this fact there can be no doubt; but M. Payen being of opinion that the starch may undergo a molecular modification by the act of rubbing, merely crushed it by pressing it between two plates of glass, and it was in this way that he observed, as I have just stated, that the starch was solid and organised to the centre, and that it did not yield to cold water any soluble part colourable by iodine. I deduce, from my original experiments, a confirmation of the correctness of this statement, from which it appears to result, that the rubbing of the starch in water is sufficient to alter its molecular constitution, and to render a part soluble. I agree with M. Payen, that the starch is organised to the centre; but I still think, as far as regards potato starch, that there is a great difference between the strong and compact organisation of the exterior part, and that of the central part, which separates from the former, and may be diffused through water in the form of flocculi, colourable by iodine.

I shall not follow M. Mayet in the correct account which he has given of the growth of the starch grains, and of their transformation into dextrine and glucose by the action of acids of or diastase, &c. I shall also pass over the second part, which treats especially of the different medicinal feculæ. I only regret that he has not mentioned the remarkable difference of organisation, which I have observed, between the starch of wheat and that of barley, a difference which has enabled me to explain how so accurate a chemist as Proust could suppose that barley flour contained 55 per cent. of a principle similar to lignine, to which he has given the name of *hordine*, and which, nevertheless, does not exist.

There is also some confusion in the description of the different kinds of arrow-root and sago. Thus the fecula called by the English Indian arrow-root, came, ten years back, exclusively from Jamaica, where it is produced by a variety of the *Maranta arundinacea*, which M. de Tussac believed to have come from India, and on that account named it *Maranta Indica*. But this plant is indigenous to Jamaica, and it is from its fecula only that I have been able to say that it does not differ in any respect from that of the *Maranta arundinacea* cultivated in the Antilles. I ought to add, that the *Maranta Indica* or *arundinacea* has been introduced into India, where it did not originally exist, and it is now cultivated there only with a view to the sale of the feculæ, so that it now, more than formerly, merits the name of Indian arrow-root, which has been given to it by the English, even whilst procuring it from Jamaica. As to the original Indian arrow-root, which is extracted at Travancore, according to Ainslie, from the root of the *Curcuma angustifolia*, it is easily distinguished by its form, which is sometimes ovoid, sometimes elongated, of considerable size, rounded at one of the extremities, and terminating in a point at the other, often resembling a grain of rice.

For many years also, the English have obtained from Tahiti and other islands of the South Sea, a fecula known by the name of Tahiti arrow-root. It is generally spherical, but also often ovoid, elliptic, or rounded, with a prolongation in the form of a neck, suddenly terminated by a plane. Many other starch grains are also terminated at the half or two-thirds of their length by a plane perpendicular to the axis, or by two or three planes inclined between them, which may be attributed to a stoppage of growth caused by the contact of other grains: that which particularly distinguishes this fecula is a very large and circular hilum on each grain, and frequently the appearance of cracks or black streaks in the form of rays. It is almost entirely dissolved on boiling it for some time in water, leaving only a slight flocculent residue, scarcely perceptible, and which remains suspended in the liquid without being deposited.

With regard to sago, I think there yet remains much uncertainty as to its origin; it has been stated to be produced by the *Cicas*

revoluta and *circinalis*, *Arenga saccharifera*, *Phœnix farinifera*, and different species of sagus; and at so great a distance it is difficult to decide as to which of the trees really produce the sagos of commerce, for there are several kinds. Planche, in an excellent memoir on the sagos, has described six species, which he distinguishes by the names of the places from which they come. Preferring to classify them according to their characters, I distinguish only three species.

FIRST SPECIES.

Ancient or First Sago.—I cannot otherwise designate this species, which comes from different parts, and varies much in colour. It comprehends:—

1st. *Maldivian Sago* of Planche, in spherical globules, of two or three millimetres in diameter, translucid, of an unequal pinkish white colour, very hard and insipid.

2nd. *New Guinea Sago* of Planche, in rather smaller globules, of a bright red colour on one side, and white on the other. All the coloured sagos, as is known, have this character.

3rd. *Gray Sago of the Moluccas*, or *Brown Sago of the English*; of unequal globules, from one to three millimetres in diameter, opaque, of a dull gray colour on one side, and whitish on the other. I think that this gray colour is not natural, and that it arises from an alteration of the original rose-colour—a change caused by long keeping and by humidity.

4th. *Large Gray Sago of the Moluccas*; exactly resembling the preceding, only that the globules are from four to eight millimetres in diameter.

5th. *True White Sago of the Moluccas*; entirely resembling No. 3, only that it is purely white, owing to the complete edulcoration of the fecula of which it is made.*

Wherever may be the places of origin of these sagos, they all possess the following characters:—

Rounded globules, generally spherical, all isolated, very hard, elastic, and difficult to break or powder.

The globules put into water, generally swell to twice their original size, but do not adhere together.

The grains of which the globules are composed, when isolated from each other by agitation with water, coloured with iodine, and viewed under the microscope, present an ovoid, elliptic, or elongated elliptic form. The elliptic grains are often compressed into a kind of neck at one extremity, and this neck is sometimes inclined on the axis. The granules frequently appear cut by a plane perpendicular to the axis, or by two or three planes inclined between them. This character resembles that of the fecula obtained from the *Tacca pinnatifida*; but this is generally spherical, while that of the sago is almost always elongated. The hilum is dilated.

The water in which the true sago has been macerated, on being filtered, is not coloured by iodine. After boiling for more than an hour in a large quantity of water, the sago fecula leaves a considerable deposit, dense, and easily separated from the liquid; this residue, coloured with iodine and viewed through the microscope, appears composed of very thick integuments, almost entire, or lacerated, of a white or violet colour; and of a parenchymatous matter, also very thick, and of a violet colour.

SECOND SPECIES.

Second Sago.—This species corresponds with the pinkish sago of the Moluccas of Planche. It is in very small globules, less regular than those of the first sago, and sometimes stuck together to the number of two or three. Soaked in water, it swells to double its volume, and the water appears slightly mucilaginous, yet it is not sensibly coloured by iodine. The isolated grains of the fecula have exactly the same form as those of the sago No 1, but they are less acted upon by boiling with water. After boiling for an hour, the liquid holds the parenchymatous portion of the starch in suspension, which is coloured of a reddish violet by iodine, and which frequently presents an opaque point, more highly coloured in the centre. On being allowed to stand, a very dense deposit collects at the bottom of the liquid, which consists of fragments of teguments, membranous, folded, dense, and of a violet colour, and other teguments less altered, hollow, and torn at several points on the surface, and of a violet blue.

THIRD SPECIES

Tapioca Sago.—I apply this name to this species of sago, now so abundant in commerce, because it bears the same relation to the ancient, or first sago, and even to the preceding sagos, that tapioca bears to

* This white sago, which sometimes comes from India or the Moluccas, as well as the New Guinea sago, and the gray Molucca sago, must not be confounded with the artificial sago, made from potato starch, which can be made white, red, or gray, and which perfectly resembles the real. The sago of potato starch may always be known by its taste of starch.

"*Moussache*" (tapioca meal?) which is the fecula of the *manioc* (*Jatropha manihot*); that is to say, that whilst the two preceding species of sago, whatever may have been stated to the contrary, have been neither baked nor submitted to any heating process, as is proved by the perfect state of nearly all their grains of fecula, this, the tapioca sago, has been submitted to the action of heat while in the state of a moist paste. This offers an explanation of all its characters.

This sago is not in spherical globules like the two preceding species, or at least there are but very few of the globules of that form. It is rather in the form of very small irregular tubercular masses, formed by the adherence of different numbers of primary globules. Soaked in water, it swells very much, and becomes a pasty mass, white and opaque. On the addition of more water, it further divides, and partly dissolves. The filtered liquor is strongly coloured blue by iodine. The unfiltered liquor, examined through the microscope, exhibits entire grains of fecula resembling those of true sago, and also a great number of broken and torn integuments. A small quantity of this fecula boiled for an hour in a considerable quantity of water, behaves itself in a similar manner to sago No. 2.

The facility with which the tapioca sago swells, and is divided by water, has occasioned its being, in the present day, preferred as an article of food, to the ancient sago. It has been described by Planche under the name of the white sago of the Moluccas, and by Dr. Pereira under the name of pearl sago. M. Goubert, a French merchant established at Sydney, sent me a specimen, stating that it came from Tahiti. From this I thought, for some time, that this sago was the tapioca of the fecula of the *Tacca cinnatifida*, but this it certainly is not.

ON THE CONDITION OF THE URINE IN URTICARIA.*

BY DOUGLAS MACLAGAN, M.D.

Dr. Douglas Maclagan has submitted to the Edinburgh Medico-Chirurgical Society some chemical analyses of the urine, in a case of urticaria, and from these some interesting conclusions may be drawn. The urine was analysed by the process employed

"By M. Becquerel, in his *Semeiotique des Urines*, by which the amounts of water, urea, uric acid and inorganic salts, are determined. The results obtained from the urine in the present instance were the following:—

Urea	6·91
Uric acid	0·05
Inorganic salts	12·03
Other organic matters and water	981·01
	1000·000

"Albumen was carefully tested for, but no trace of this substance was discovered.

"The peculiarities of this urine will best be appreciated by contrasting it with the proportion given by Becquerel as the mean of the urine of healthy males. According to him, that is—

Urea	13·838
Uric acid	0·391
Inorganic salts	7·695
Other organic matters and water	078·076
	1000·000

"It appeared, then, from this analysis, that the chief peculiarity in the present case was a deficiency in the ordinary characteristic ingredients of the urine, the urea and uric acid. This could not arise from mere excess of water; first, because the urine was not excessive in quantity; second, because the inorganic salts were above the normal standard; whereas, had the water merely been in excess, they, too, ought to have indicated a diluted condition of the urine. Dr. Maclagan ventured, therefore, to propose, as the pathological view of the case, that the defect here was merely a deficiency of the urea and uric acid; in short, a want of what modern chemists call the products of transformation of the tissues, and that the retention in this way in the system, of matters which ought to be eliminated from it, might be the cause of this cutaneous irritation, especially occurring, as it did, after meals."

The means by which this state of matters could be remedied was the next subject for consideration, and, accordingly, colchicum was administered. The result was favourable, for as soon as the medicine had been made use of, the urine was found to be of a specific gravity 1029·9, and to contain,

Urea	20·36
Uric acid	0·50
Inorganic salts	12·72
Other organic matters and water	966·42
	1000·00

The conclusions to be drawn from the facts set forth are—1st. That urticaria is intimately connected with a deficiency of the organic salts of the urine, and their probable retention in the system.

2ndly. That colchicum has an action ca-

* *Lancet*.

public of restoring the deficient salts, and thus curing the disease.

3rdly. Rheumatism and urticaria, and purpura and urticaria, are frequently found to be present together. They are also benefitted by the use of colchicum. It may be easily asked, do they not depend on the same common cause, viz., the presence of those salts in the blood? Such an inference has been applied in the case of rheumatism.

EXPERIMENTS ON THE COMPOSITION OF AIR COLLECTED AT DIFFERENT HEIGHTS IN A CLOSED ROOM, IN WHICH A GREAT NUMBER OF PERSONS WERE BREATHING; FOLLOWED BY CONSIDERATIONS ON THE THEORY ESTABLISHED IN THE CASE OF CERTAIN VENTILATORS.*

BY J. L. LASSAIGNE.

The changes undergone by air in the act of respiration in man, and the principal domestic animals, have for a length of time imposed on us the observance of certain hygienic rules; particularly in the case of rooms in which a great number of people have assembled. The rules which at present regulate the construction of the new descriptions of apparatus that have been invented, to heat and ventilate large buildings, and other public establishments, of greater or less extent, appear to be founded upon the principle, admitted perhaps without consideration, that air, vitiated by respiration, occupying the lower part of the room, is incessantly renewed by the means by which it is continually forced outwards.

This opinion, which has been acquiesced in by several deserving authors, has, however, never been confirmed by experiment, that we are aware of; yet, nevertheless, it has been repeated and adopted, without dispute, by most of those who have written on the most recent apparatus for warming and ventilating.

The assertion made in this case has always appeared to us to have been opposed to the physical law, "on the mixtures of elastic fluids with each other, and with vapours." It is admitted, contrary to the laws regulating the mixture of fluids, that "various elastic fluids, either simple or compound, which exhibit no chemical action on each other, are uniformly distributed through the whole extent of a limited space, independently of their respective densities." We know that this fundamental truth was placed beyond doubt by the illustrious chemist, Berthollet, at the commencement of the present century, and confirmed and extended afterwards by the beautiful experiments of M. Gay-Lussac.

In 1842, M. Felix Le Blanc, in an interesting work, entitled, "Experiments on the Composition of Confined Air," has proved by the analysis of air collected in the cabinet of the Opera Comique (*Salle Favart*), after a representation at which about a thousand spectators had been present, that the air, both in the upper and lower regions, contained carbonic acid; that the proportional amount of this gas rose as high as $\frac{1}{1000}$ in the first instance, while in the pit it was $\frac{1}{1400}$. This result, inserted in the *Annales de Chimie et de Physique*, vol. 6, 3rd series, page 223, &c., proves, therefore, that the most vitiated air, or that containing the greatest quantity of carbonic acid, is not to be found in the lower region alone, as it has been perhaps too readily admitted.

Although this fact does not exactly represent what takes place in a large ventilated room, where respiration takes place, alone, and unaccompanied by the products of the combustion of lights (a constant source of carbonic acid) we were obliged to mention it in this place to contradict the opinion too generally expressed, during the host of questions applicable to public or private health.

Having latterly had the task imposed upon us of giving our advice as to the means of heating and ventilation to be adopted, in a public amphitheatre, in the course of construction, we were necessarily obliged to inquire into the proposed process, and the theory on which the author of the system founded its advantage and utility. We were astonished after reading the different publications on this subject, to perceive an opinion adopted, admitting that "it was in the lower and cold layers on a level with the flooring, that the carbonic acid collects, the product of respiration, as well as the other miasmatic substances, to be removed by the proposed system."

It was for the purpose, therefore, of verifying, by experiment, this assertion, to which we could not adhere without previous examination, that we undertook the following researches. Our experiments were made on air collected in a small amphitheatre, of the capacity of 280 cubic metres, in which the air it contained could not be renewed during the duration of a lecture for the space of an hour and a half. The results we obtained confirmed several facts already noticed by M. Felix Le Blanc, in the memoir he published in 1842.

In making these new experiments, we took every precaution to prevent the possibility of any other cause, except respiration,

* *Journal de Chimie.*

altering the composition of the air. To calculate as correctly as possible, in these experiments, the real volume of the air contained in the amphitheatre, after the introduction of 55 persons, we deducted from the capacity of the empty amphitheatre the average volume of the parties present.

For the purpose of determining this last amount, which we had made an element in our calculations, we determined, by direct experiment, the apparent volume of the body of a man of middling size; and we found, by the water displaced in a bath, that it was equal to 64 lit., 240 or 0m.c. ·6424.

If we admit that this last number represents the volume of a man without his clothes, we can, without being far from the truth, suppose, that when dressed, he is surrounded with a layer of the average thickness of from 0m. ·003 to 0m. ·004; consequently, that when dressed, his volume would be 0m.c. ·6464.

By multiplying the number of persons, 55, placed in the amphitheatre for an hour and a half, and subtracting the amount of the total volume of the air contained in the amphitheatre, we obtained the real volume of air in which the 55 persons would have to breathe, as we may see by the following calculation:—

280,000 lit. of air. — Capacity of the amphitheatre, deducting the volume of the furniture.

5,520 ,, — Volume of the 55 persons admitted into the amphitheatre.

Dif. 276,480 litres of air.

The number 276,480 litres, therefore, represents the real volume of the air contained in the amphitheatre, after the introduction of 55 persons; by dividing the first number by the second, we discover the quantity of air given out by each of the audience during one hour and a half; this amount is equal to 5,026 litres.

The 29th of May, 1846, at half-past eleven in the morning, I collected, by means of two bottles filled with dry mercury, the air present at the end of the lecture; one part was taken close to the ground, and the other at the height of the ceiling, which was 3m. ·80 above the floor.

The usual openings of the amphitheatre had been carefully closed, as well as the fire-place, the entrance to which was covered up to prevent the admission of fresh air during the sitting.

The analysis of these two samples of air was performed in the mercury trough, by absorbing, in the first instance, the carbonic acid it contained, by means of a concentrated solution of potash, in alcohol, and afterwards calculating the proportion of oxygen that remained, by means of phosphorus.

The following are the results we obtained in a volume of air equal to 100, at a temperature of 66 F. Barometer = 0m. ·764.

Air collected at the ceiling, at 3m. 80c. from the floor.	Oxygen.....	19·80
	Nitrogen.....	79·58
	Carbonic acid..	0·62
Air collected close to the floor.	Oxygen.....	20·10
	Nitrogen.....	79·35
	Carbonic acid..	0·55

The proportion of carbonic acid discovered in these two analyses shows that it differed but little in the more elevated regions of the amphitheatre, where the experiment was made. By taking the average, we obtain 0·58 carbonic acid for every 10,000 parts of air which had served for the respiration of 55 people; for the air containing in its normal state $\frac{4}{10000}$ parts of carbonic acid, it is evident that, after the respiration of 55 people, it contained $\frac{58}{10000}$, or, from 11 to 12 times a larger quantity.

This proportion of carbonic acid in the air of the amphitheatre, after a lecture of an hour and a half, carries that contained by the whole of the air to 1,603 m. ·78. By deducting from this amount that which represents the volume of carbonic acid, naturally existing, before the phenomenon of respiration had taken place, we have 1,603·8 —138·2 = 1,465 lit. ·6. This last amount, divided by 55, gives the volume of carbonic acid disengaged or extracted by each individual, which is 26 lit. ·64 for one hour and a half, or 17 lit. ·76 per hour.

The average volume of a man of the ordinary height and size, being calculated, according to our experiments, at about 64 litres, the proportion of carbonic acid exhaled by this man in an hour would be equal to $\frac{1}{3\frac{1}{2}}$, or 0·281 of his own size; that is to say, rather less than the third of the volume of his body, under the conditions of temperature and pressure noticed above.

The weight of this quantity of carbonic acid, reduced to 0 of temperature, at a pressure of 0 m. ·760 is 32 grs. ·85, and represents 8 grs. ·96 of carbon consumed per hour. These results, deduced from the experiments made under the conditions above noticed, are very nearly the same as those indicated by M. Dumas, in his "Chemical Statistics of Organised Beings."

In a second experiment on the air of the amphitheatre, in which the same number of persons had breathed, for the same space of time, we observed that the composition of the air collected in the lower and more ele-

vated regions was nearly the same. The precautions for closing the room in which our experiments were made not being so well observed as in the first instance, we found that the proportion of carbonic acid was rather less; it amounted to $\frac{41}{10000}$ in the air collected near the ground, and $\frac{42}{10000}$ in that taken near the ceiling. We attribute this slight difference to the renewal of the air from the fire-place, which, in this instance, had not been closed.

In conclusion we may observe:—

1. That in those parts where the air has been confined, and has served for respiration for a certain period, the proportion of carbonic acid exhaled was not exclusively found in the lower region, as some authors have asserted.

2. That, in conformity with physical laws, and also by the sanction of experience, carbonic acid is found nearly equally distributed through the whole mass of the air, which has served for the respiration of a certain number of persons.

3. That the slight difference observed in this respect has a tendency to show that the proportion of carbonic acid is rather greater in the higher part of a limited quantity of air, as the result of our experiments has proved; if, indeed, these variations do not arise from possible errors in the determination of the volume of the gaseous elements of the atmospheric air.

4. The ideas with which the experiments related in this memoir furnish us, show how erroneous are certain theories of ventilation, now put in practice; they point out the importance of renewing the whole mass of air in places where a large number of men are assembled, for the purpose of removing the vitiated atmosphere produced by respiration.

5. The large apparatus for ventilating and warming now in use in many of the public buildings of the capital, assist in effecting the renewal of the whole mass of the air contained within them to a greater or less extent, and not by removing the vitiated air which is supposed to be collected in the cold or lower region.

6. The distress we feel by breathing the air that fills the upper region of badly ventilated theatres and places of public meeting, is chiefly caused by the great rarefaction of the air by heat. This cause renders the respiratory action more rapid and deeper, and produces an order of physiological facts differing from those in a normal state.

ON THE EMPLOYMENT OF CITRATE OF IRON AND AMMONIA, IN THE FORM OF PILLS OR SACCHARINE COMPOUNDS.*

BY M. BERAL.

CITRATE OF IRON AND AMMONIA.

Citrate of iron, and those compounds which have this product for a base, belong, from their medical propensities, to the class of tonics; they are introduced to the notice of medical men as a remedy, and as the basis of a mode of treatment, in diseases requiring the employment of preparations of iron.

If, up to the present time, simple citrate of iron, that is to say, the result of the combination of citric acid with peroxide of iron, alone, has been employed, it was because we had no idea of the combination of citric acid with peroxide of iron and ammonia. The first part of the *brevet*, therefore, applies to a citrate resulting from a combination of citric acid with peroxide of iron and ammonia, a product to which I give the name of citrate of iron and ammonia, and by abbreviation that of citrate of iron. I also claim the exclusive right to sell the new citrate, under every form, and particularly as

1st. Under the form of a syrup, and under the name of citrate of iron.

2nd. Under the form of a powder, and under the name of saccharide of citrate of iron.

3rd. Under the form of a pastille, by the name of pastilles of citrate of iron.

4th. Under the form of pills, as, pills of citrate of iron.

Employment of simple Citrate of Iron, as a Saccharide, and as Pills.—The object of the second part of my *brevet*, is, not the composition of simple citrate of iron, that is to say, the result of the combination of citric acid with peroxide of iron, alone, and without ammonia, this simple citrate of iron being already known; until the present day it has only been employed under the form of syrup and pastilles, and not as pills and powders, or saccharide.

Mode of preparing Citrate of Iron and Ammonia.—

R. Distilled water	2,000	grammes.
Crystallised citric acid	875	,,
Liquid ammonia	350	,,

Dissolve in a platina basin, and after solution, place the mixture on the fire; when it boils, throw in, by degrees, about 2,000 grammes of hydrated peroxide of iron, still moist.

When the oxide is dissolved, allow the solution to cool, for the purpose of filtering it, reduce it to the consistence of syrup,

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spread out the product on glass plates, and dry it by a stove heat, so as to obtain the citrate under the form of transparent scales, of a beautiful garnet colour.

The quantity of hydrated peroxide of iron ought to represent 500 grammes of dry peroxide. Thus prepared, the dry citrate of iron is completely soluble, unchangeable in the air, always identical, and free from the styptic taste we meet with in other preparations of iron.

Formula of Syrup of Citrate of Iron.—

℞ Simple syrup	28	grammes.
Anhydrous citrate of iron and ammonia	1	,,
Saccharide of cloves and vanilla	1	,,

Formula of Saccharide of Citrate of Iron, for ferrated Water.—

℞ Sugar, in powder	22	grammes.
Anhydrous citrate of iron and ammonia	1	,,
Saccharide of cloves and vanilla	2	,,

Mix them well.

Formula of Pastilles of Citrate of Iron.—

℞ Sugar, in powder	16	grammes.
Anhydrous citrate of iron and ammonia	1	,,
Saccharide of cloves and vanilla	1	,,

After forming these substances into a paste, we divide the latter into pastilles of 90 centigrammes each.

Formula for Pills of Citrate of Iron.—

℞ Sugar, in powder	12	grammes.
Anhydrous citrate of iron and ammonia	4	,,
Mucilage of gum arabic, *q. s.*		

Make it into a mass, and form it into pills of the weight of 20 centigrammes. These ought to be silvered.

AMORPHOUS QUININE.

BY J. LLOYD BULLOCK.

THE following letter on this subject appeared in the *Lancet* of the 22nd inst.:—

Sir—You have admitted into the *Lancet* an attack on me, and on the preparation I have recently introduced to the profession, under the title of amorphous quinine, from Mr. Redwood, of the Pharmaceutical Society.

May I beg the insertion of the following reply?—In the first place, I deny the accuracy of Mr. Redwood's statement *in toto*. That my preparation is entirely soluble in ether I never asserted, but that thirty per cent. of it is insoluble in that menstruum, is a mistake I can only account for by supposing some inaccuracy in Mr. Redwood's method of weighing or estimating the amount. Professor Liebig remarks, that "it is necessary the amorphous quinine should be separated from all admixtures and impurities, and employed in its pure state;" this remark refers to the substance known as chinoidine, which, as found in commerce, oftentimes contains only a very minute per centage of amorphous quinine, and sometimes none at all. He, therefore, doubtless, intended to convey the impression that chinoidine should never be prescribed.

Your readers well know, if Mr. Redwood does not, that many organic substances undergo various transformations or changes when subjected to various processes and influences. They are perfectly familiar with examples of such bodies, having exactly the same constitution and composition, existing under two or more modifications, which are sometimes only distinguishable by the one being soluble in a given menstruum, while the other is insoluble. Will Mr. Redwood have the goodness to publish his analysis of the "substance" insoluble in ether, and and which he asserts is not amorphous quinine? His communication, I think, shows the weakness and backwardness of English pharmacy. It is always seeking some rule of easy application to save trouble and labour. I allege that nothing short of careful, repeated chemical analysis by the well-known process of combustion, and estimation of its constituent elements, could warrant Mr. Redwood's assertion, that my patent preparation contains one per cent. of anything save amorphous quinine. It is not my intention, however, to make known, at present, all the information I possess relating to quinine and its modifications. It must suffice for me to say, that the extraordinary effects attributed to the amorphous variety as a medicinal agent, attach to it an interest beyond any other point in therapeutics. It was consequently a matter which I considered involved a duty to the public, to obtain a patent for their protection from spurious and adulterated articles. When my specification is published, every one may know *my method* of preparing amorphous quinine. From various quarters I continue to receive testimonials to its superior efficacy to the crystalline variety. If this is in any way attributable to the amorphous being used in combination with vegetable acids, the profession may experiment upon the salts of the crystalline variety, with those acids, and compare the results. I will go a little further. *I possess a method of converting one into the other*, which I shall make known in due time.

You, perhaps, have not considered the broad distinction between patents and what

are called patent medicines. By a patent, the inventor or discoverer of anything useful to the public, gives the fruits of his labour to that public, reserving its preparation for a short term of years as his reward.

What are called patent medicines are not made patent at all, they are mere secret mixtures, offered to the public who cannot judge of the diseases to which they profess to be applicable, and in whose hands, if they be not wholly inert, such medicines are most dangerous. The case seems to me entirely, and in every respect, different. I cannot see on what principle the discoverer in pharmacy is to be precluded from the benefit of his labours. Suppose I know a method of obtaining morphine or aconitine, artificially, by which I can place in the hands of the prescriber these substances at half the price usually charged for them—have I no right to benefit by my discovery?

In some cases—and I, of course, consider my own to be one of them—I think the public are better off with a patent than without. In other cases, patents may be objectionable.

I have just received the following from Dr. Schäffer, staff-physician, Darmstadt:—"In confirmation of the efficacy of the amorphous quinine lately spoken of by Professor Liebig, I beg to say I have used it for some years in Darmstadt and its neighbourhood, by means of a preparation of my own; and I have invariably found it most efficacious and active. My plan of treating intermittent and remittent fever is, to begin with an emetic, and to follow with this preparation, continuing smaller doses for ten days or a fortnight after the last paroxysm. I have employed this remedy upon very many patients who had been treated by other physicians with ordinary quinine without success, and invariably succeeded in ridding them completely of fever.—Darmstadt, June, 1846."*

* *Journal de Chimie.*

THE EXERCISE OF MEDICINE AND PHARMACY IN FRANCE.—A HINT TO THE MEDICAL PRACTITIONERS OF ENGLAND.

By a decree of the Mayor of the city of Lyons, it is no longer legal to paste upon any of the walls of that city, advertisements announcing medical treatment, or any description of remedy.

1. It would be extremely desirable, if this plan was adopted in Paris, and in other cities of the kingdom.

2. That the advertising in the journals any kind of medical treatment or special remedies should be prohibited. This would be almost equal to a law in favour of the legal exercise of medicine and pharmacy.

MISCELLANEA.

PUBLIC HEALTH.

The Register-General's quarterly returns of the state of the public health are obtained from 115 districts; 34 districts are placed under the metropolis, and the remaining 81 districts comprise, with some agricultural districts, the principal towns and cities of England. The population was 6,570,693 in 1841. 43,582 deaths were registered in the spring quarter ending June 30—a number greater by 2,163 than were registered in the corresponding quarter of 1844. The districts of Lancashire and Yorkshire were the most unhealthy. The inadequate supplies of water by companies, the imperfect sewerage in towns, the open drain and ditches, and the general neglect of cleanliness, leave everywhere great quantities of organic matter to decay and putrefy in the midst of crowded populations. In such circumstances the mortality, like putrefaction, is always increased when the temperature is high; and epidemics of diarrhœa, dysentery, and cholera prevail. The deaths in the quarter were 43,582. In the metropolis, the deaths at the close of June, from diarrhœa, dysentery, and common cholera rose to fifty weekly, and have since increased until they reached to the number of 149. In Liverpool, Sheffield, and the towns of the north, epidemics in the last quarter were more fatal than they had been before; and the deaths, in proportions to the population, were at least one-third part more numerous than in London. The mean temperature at Greenwich, of the 13 weeks ending June 27th, is 55 deg. 2 min., which is 2 deg. 3 min. above the average of the corresponding quarter of 1845—the temperature of the same season, in 1844, when the wheat crop was so abundant. Five and a half inches of rain have, however, fallen in the present quarter, and the winter of 1846 was of extraordinary mildness; while the winter of 1844 was of more than the average severity. The temperature of the Thames was 59 deg. 4 min. in the day, 58 deg. 3 min. in the night.

THE PROPOSED DRUGGISTS' EXCISE BILL.

THE bill for putting a great many medical practitioners, chemists, druggists, perfumers, and varnish-makers, under the excise laws, by energetic and combined action on the part of the intended victims, *has become defunct*. It had passed through all its readings, and at last hung simply on the motion, "That this bill do pass." At that point, Mr. Wakley obtained from the Chancellor of the Exchequer his assent to postpone the consideration of the bill for ten days, and the result is, that the bill has been abandoned by the government. It is only a duty to state that we know that the government had been all but entrapped into the adoption of this measure, and that they have abandoned it in a highly creditable manner.

ARTIFICIAL GOLD.

IMITATION gold, which not only resembles gold in colour, but also in specific gravity and ductility, consists of 16 parts of platinum, 7 parts of copper, and 1 of zinc, put in a crucible, covered with charcoal powder, and melted into a mass.

WORTHINGTON'S TIDE POWER.*

THE storing of tidal power, as a motive power for machinery, has often been suggested, but there has always been the difficulty to overcome, of getting rid of the back-flood, which would stop the revolving wheel. Mr. Worthington, of Manchester, thinking he had discovered the means of obviating this difficulty, wrote some years ago to the Liverpool papers on the subject; but was unable to make his views sufficiently intelligible without a model.

Accordingly, he at length determined to construct one, and having completed it, he is now exhibiting it to the public. It is on a tolerable large scale, and is a working model, the water of a miniature sea flowing into two half-tide reservoirs, and from them through wheel-races, so as to turn an undershot wheel, which is supposed to give the motive power. At high water the sea will fill these trough sluices; at low water the sluice-gates or paddles are closed, and the water retained in the reservoir in sufficient quantity to serve the wheels, till the tide returns to give a fresh supply. Whenever, from high tides, or other causes, the water rises higher than the centre of the water-wheel, the wheel would become what is termed, "back-flooded." To avoid this, a third reservoir is constructed at a lower level below that of the low-water mark, and into this the waste water from the wheel runs at flood-tide, and is let out at low-water, to flow back to the river or sea through a sluice, which must be closed again when the reservoir is empty. Mr. Worthington suggests that, at sea-ports, such as Liverpool and Hull, long river or sea-walls be built, so as to impound the tidal water behind them, in reservoirs, and that the corporate bodies of these towns might let the power for mill purposes. Perhaps, one of the largest water-wheels in the kingdom is at Compstall-Bridge, and it is there found that a reservoir of five acres, holding seven feet of water, will rotate this wheel during eight hours with a motive power equal to that of 300 horses. Of the practicability of Mr. Worthington's plan, we do not undertake to express an opinion; we merely describe it, and leave our readers to judge for themselves.

* *Manchester Guardian.*

AMERICAN WHITEWASH.

THE following recipe is given by the *New York Sun*, which is used for preparing the celebrated stucco whitewash used on the east end of the President's house at Washington:—"Take half a bushel of nice unslacked lime; slack it with boiling water, covering it during the process to keep in the steam. Strain the liquor through a fine sieve or strainer, and add to it a peck of clean salt, previously dissolved in warm water; three pounds of ground rice, ground to a thin paste, and stirred while boiled hot; half a pound of powdered Spanish whiteing, and a pound of clean glue, which has been previously dissolved by first soaking it well, and then hanging it over a slow fire, in a small kettle, within a large one filled with water. Add five gallons of hot water to the whole mixture; stir it well, and let it stand a few days, covered from dirt. It should be put on quite hot; for this purpose it can be kept in a kettle on a portable furnance. It is said, that about one pint of this mixture will cover a square yard upon the outside of a house, if properly applied. Brushes, more or less small, may be used, according to the neatness of the job required. It retains its brilliancy for many years. There is nothing of the kind that will compare with it, either for inside or outside walls. Any required tinge can be given to the preparation by the addition of colouring matter."

KNIFE SWALLOWING.*

JOHN D——, aged seven years, residing at 10, Salisbury-terrace, Islington, on the evening of the 6th of August, swallowed an open penknife, three inches long. The lad, a very sickly one, was subsequently visited by two medical men; the symptoms afterwards were slight, chiefly febrile, with occasional griping pains, and some tenderness, in the region of the bowels. The treatment enjoined was perfect quietude, fomentations, saline febrifuges, sedatives; the occasional exhibition of slight aperients, castor-oil, &c. On the morning of the sixth day, contrary to the opinion of some eminent physicians, to whom the case had been related, the knife appeared with an evacuation, blade downwards, somewhat corroded, and not at all improved in appearance by its change of residence.

DISCOVERY OF ANOTHER PACTOLUS.

A BELGIAN paper gives the following strange tale, the truth of which it vouches for, and states, that more extensive details are in its possession, and would be given, only that they might be prejudicial to the realisation of the enterprise:—"A distinguished French engineer, who was sent some years ago to Panama, to make geological researches, and study the question of piercing the isthmus, has brought back some specimens of gold, which Baron Thénard, after chemical assay, has pronounced to be of the greatest richness. The engineer states that he gathered this gold in the sands of a river of the isthmus. Such are the richness of the grains of gold which this river rolls along, that the natives who are occupied in gathering them, gain fifty francs per day; and that the sands they wash contain still, after the operation, more than double the quantity of gold which they had obtained from them. The engineer had examined with care the course of the river to its source, and remarked that it traversed an enormous group of rocks, in the midst of which it must have been depositing for ages a vast mass of grains of gold. According to his estimates, there must be far more than eight milliards of francs of gold mineral buried under these rocks. (One milliard of francs, it may be observed here, is equal to forty millions sterling.) When the engineer made known the result of his researches and conjectures at home, he met with incredulous hearers, and was treated as a visionary. Notwithstanding, he has given details so precise, it appears, of the success of a future exploration, that several capitalists have resolved to confide to him the funds necessary for exploring on a great scale the sands of the river. For this purpose it was resolved not to form a company by shares, but to confide the enterprise to a certain number of capitalists willing to run the risk of the affair. The capital embarked in this undertaking will be either entirely lost, or will produce more than a million per cent. to those who subscribe the funds. The engineer himself engages not to require any share of the profits until the enterprise shall have realised three milliards of francs (one hundred and twenty millions sterling!!!) There are, as may be seen all the riches of Potosi, all the gold of Pactolus, which it is expected will be found united between the two parts of America. The preparations for the undertaking are already in an advanced state. The dredging machine boat for the operation is in course of construction; and the departure of the engineers and workmen will take place in two or three months. If this affair, which has been in hand for several years, has remained unknown to the public, the reason is, that the parties engaged in it look upon their capital advanced as being exposed to an extraordinary risk, and therefore are anxious to avoid being held up to ridicule by appearing to have too much confidence in the result of these researches. Such is the marvellous story. It is evident from the length of years spoken of since the enterprise was first proposed, that the French engineer was one of those sent out in the famous bubble year 1825, to make surveys in Panama for one of the projects of a canal, for which several companies were formed in that year in this country and elsewhere.

* *Lancet.*

TO CORRESPONDENTS.

"K. K." (Bristol)—The revised edition of the *Lecons d'Anatomic Comparé*, by Cuvier, has lately been advertised at a very reduced price, and may be had of any of the foreign booksellers in London.

"C. L." (Pimlico)—No patent medicine is allowed to be sold in France, unless its composition is declared; secret remedies being prohibited.

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month, Books for Review before the 16th.*

THE CHEMIST.

CHEMICAL NOMENCLATURE AND CLASSIFICATION; TO WHICH IS ADDED, AN HISTORICAL LEXICON OF SYNONYMES, INCLUDING THE ANCIENT NAMES, THE FORMULÆ, THE NEW NAMES, THE NAMES OF THE AUTHORS, AND THE DATE OF THE DISCOVERY OF THE PRINCIPAL PRODUCTS OF CHEMISTRY.

(*Continued from page* 393.)

BY FERD. HOEFER, DOCTOR IN MEDICINE.

This law is equally true with regard to chlorine, bromine, iodine, sulphur, and several other substances, in fact, almost all the chlorides, sulphides, &c. (perchlorurets, persulphurets, &c.) are true chloracids and sulphacids, which combine with the protochlorurets and protosulphurets (chloro-bases, sulpho-bases) to produce chloro-salts, otherwise called double chlorides.

But all oxides are not bases or acids: there are some which are indifferent—that is, they are not susceptible of combination either with acids or bases. Many *non-metallic oxides* are of this nature.

Examples:—

Protoxide of nitrogen.
Deutoxide of nitrogen.

(Lavoisier observed, "We are not content merely to call the combination of metals with oxygen, oxides, but we have felt no difficulty in using the term to express the first degree of oxidation in all substances, a state which, without constituting acids, brings them the nearest to a saline state. "Treatise on Elementary Chemistry," vol. 1, p. 85.)

Saline Compounds.—The basic oxides or oxibases can combine with acids (*oxacids*) so as to efface (neutralise) their properties; the resulting compounds are called salts. To indicate these combinations we change the termination *ic* of the acid into *ate*, and the termination *ous* into *ite*.

(Independently of these changes we strike out one or two letters in the names of several of the acids. Thus we say, sulphate, phosphate, instead of sulphurate, phosphurate.)

In the case of the *oxisalts* we generally omit the term oxide by simply giving the name of the metal.

Examples:—

Acetate of lead,
Sulphite of silver,

instead of

Acetate of oxide of lead,
Sulphite of oxide of silver.

Nevertheless, when two or more oxides of the same metal can combine with an acid and form two different kinds of salts, it is indispensable to place before the name of the metal that of its degree of oxidation.

Examples:—

Sulphate of protoxide of iron.
Sulphate of sesquioxide or peroxide of iron.

We also say in this case, salts at the *minimum* or salts at the *maximum* (of oxidation).

Examples:—

Sulphate of manganese at the minimum.
Sulphate of manganese at the maximum.

It is incorrect to say, sesquisulphate, deutosulphate, persulphate, &c., instead of sulphate of sesquioxide, sulphate of deutoxide, sulphate of peroxide, for the particles *sesqui*, *deuto*, *per*, thus placed, would refer rather to the acid than the base.

Instead of chlohydrate, iodhydrate, bromhydrate, &c., we say chloruret,* ioduret, bromuret, sulphuret; and since it is known that these acids form with the oxibases compounds in *uret*, differing from the oxisalts.

Salts can be neutral, acid, or basic. A

* Brande, when speaking of the termination *ide* and *uret*, observes—"All the combinations of oxygen, chlorine, iodine, fluorine and bromine with the imflammables and metals that are not acid, are called oxides, chlorides, &c. The combinations of the inflammable substances with each other, and with the metals, are called sulphurets, phosphurets, carburets, &c., and in some cases the combination of certain metals with each other have the same termination as arseniurets, tellurets, antimoniurets, &c.

neutral salt is that in which the properties of the acid, as well as those of the base, are neutralised, so that the tincture of turnsol is not changed by the action of these compounds, consequently, an acid salt is that in which the acid predominating reddens the blue tincture of turnsol, while the basic salt restores the blue colour of the tincture of the same substance, when reduced by an acid.

Nomenclature here again intervenes to indicate these differences. Thus the acid salts are called sur-salts (super-salts), and we designate them by the names *sesqui*, *bi*, *quadri-salts*, if they contain once and a half, twice, or four times as much acid as the neutral salt, which is taken as a comparative term.

Examples :—

Sesquicarbonate of ammonia,
Bisulphate of potash,
Quadroxalate [super, per] of potash.

Those salts, on the contrary, in which the base predominates, are called sub-salts or basic-salts. We have bibasic, tribasic, sexbasic salts, &c., when the quantity of the base is double, triple, or sextuple of the quantity of the base that enters into the composition of the neutral salts.

Examples :—

Bibasic acetate of lead.
Tribasic acetate of lead.
Sexbasic acetate of lead.

The preposition *sous* [*sub*] placed before the name of a salt, indicates, in a general manner, that the salt is basic.

Water does not play an indifferent part in the composition of acids, bases, and salts. The water of 'constitution,' (differing from the water of crystallisation, which is expelled at 312° F.) is called *hydrate*. Hence arise the compounds mono-hydrate, bin-hydrates, &c., when they possess 1, 2, &c., equivalents of water.

Lavoisier was not acquainted with the real composition of alkaline bases and earths, but his amazing sagacity, guided by analogy, caused him to suspect that the alkalies and earths were true oxides.

"It is necessary to observe," said this great legislator of science, "that the alkalies and earths enter simply into the composition of salts without any intermedium to assist them in uniting; while, on the contrary, the metals cannot combine with acids unless they are previously more or less oxigenated. We may, therefore, strictly say, that metals are not soluble in acids, but only metallic oxides. Thus, when we place a metallic substance in an acid, the first condition, to enable it to be dissolved, is, that it should be oxidated, and this cannot be done excepting by removing the oxygen from the acid, or the water with which the acid is diluted; in other terms, there is no dissolution of the metal, excepting in proportion to the decomposition of the water or the acid." ("Lavoisier's Elementary Treatise on Chemistry," vol. 1, p. 176).

The principles of nomenclature, laid down by Morveau and Lavoisier, have a reference, as we have just seen, almost exclusively to the oxacids, oxibases, and oxisalts. (The oxisalts, according to Morveau's and Lavoisier's nomenclature, are salts, properly so called. In these salts the oxygen of the acid is in simple proportion with the oxygen of the base. Thus, in the sulphates the oxygen of the base is, to the oxygen of the acid, as 1 to 3; in the phosphates as 1 to 5, &c.) We must not lose sight of this fact if we wish properly to appreciate the labours of these illustrious philosophers. All the confusion afterwards introduced into the nomenclature, applied, in the first instance, to the oxigenated compounds of mineral chemistry, has been, since that time, equally applied to organic chemistry, without having previously received the necessary modifications. No science has made a more rapid progress than chemistry. Discovery has quickly succeeded discovery. Every five years chemistry has in a manner changed its aspect. In this manner Morveau's and Lavoisier's nomenclature found itself soon overburdened with facts. Instead of entirely reforming it, we were content with a few slight modifications, which served rather to obscure the science than to simplify it.

These reflections naturally present themselves when we consider the numerous compound substances ending in *uret* and *ide*, to which has been given the name of haloid salts.

Morveau advised the giving the termination *uret* to substances, which, when combined with other bodies, are neither acid nor basic; for example—sulphuret of iron. Thus we call sulphuret every combination of sulphur, not brought to an acid state; this name will thus replace in an uniform manner the improper and discordant names of liver of sulphur, hepar, pyrite, &c. ("Morveau, on the Development of the Principles of Nomenclature." Read before the Academy, 2nd May, 1787.)

If a body terminating in *uret* is capable of combining in several proportions with the same quantity of the same body, we employ, as in the case of the oxides, the prefixes *proto*, *sesqui*, *bi*, *deuto*, *per*, &c.

Examples :

Protochloruret of mercury,
Bichloruret of mercury,
Sesquichloruret of iron.

Some chemists have proposed the termination *ide* to those compounds in which the greatest proportion of chlorine, bromine, iodine, sulphur, &c., enters.

Examples :—

Chloride of phosphorus,
Chloride of arsenic.

According to the principles established by M. Berzelius, it is the electro-negative principle which is placed first (the generic name), and that it receives the termination *uret*.

The progress of science has rendered evident the inapplicability of this part of the nomenclature. The whole series of compounds in uret may be assimilated with the class of oxigenated compounds. In fact, many of the chlorurets, sulphurets, &c., behave like two acids, while others perform the office of bases. It is usually the perchlorurets that perform the part of acids, while the protochlorurets act as bases. It is the same, as we have already seen, in the case of the peroxides and protoxides.

Thus we have the perchloruret of platina, the perchloruret of tin, the perchloruret of mercury, producing, with the chlorurets of sodium and potassium, crystallisable compounds in definite proportions. These compounds, commonly called double chlorurets, are true salts, and we shall call them chlorosalts. In this case the chlorine of the acid corresponds with the chlorine of the base, as in the oxisalts, the oxygen of the acid is in proportion to the oxygen of the base. On this account we ought to call the perchloruret of platina chloroplatinic acid, the perchloruret of mercury chloromercuric acid, the perchloruret of tin chlorostannic acid. The chlorurets, on the contrary, that perform the part of bases, ought to be called chlorobases or chlorides, in fact, they act like oxibases or oxides. Finally, in the same manner as there are *indifferent* oxides, are there chlorurets that are neither acid nor basic. For these we may preserve the name of chlorurets, on the condition, however, that the term oxyurets be given to the indifferent oxides for the purpose of obtaining, as nearly as possible, unity and simplicity.

The following table will show at a glance what we intend :—

Acids.	Bases.	Indifferent Compounds.
Oxacids	Oxides	Oxyurets
Sulphacids	Sulphides	Sulphurets
Selenacids	Selenides	Seleniurets
Chloracids	Chlorides	Chlorurets
Bromacids	Bromides	Bromurets
Iodacids	Iodides	Iodurets
Fluoracids	Fluorides	Fluorurets
Cyanacids	Cyanides	Cyanurets

The nomenclature, thus modified, is more conformable to the progress of science; it also opens a vast field to the spirit of discovery.

Many reforms or modifications have been already proposed by philosophers of great merit. Some in the nomenclature itself, others in the mode in which the atomic constitution of compound bodies is to be considered.

M. Berzelius has generalised the principles of the French nomenclature by applying the terminations *ous* and *ic* (*osum* and *icum*, in Latin), not only to acids but also to oxides and salts.

Examples :—

Ferrous oxide (protoxide of iron),
Ferric oxide (peroxide of iron),
Ferrous sulphate (sulphate of peroxide of iron).

The authority of the celebrated Swedish chemist has caused this modification to be adopted by a considerable number of chemists, principally those of the north. It is more particularly in the Latin formulæ of the Codex and Pharmacopœia that this generalisation of the nomenclature is of easy and commodious application.

The Germans give the name *oxydul* to the protoxide, reserving that of oxide for the degree of oxidation immediately above that. This term has, within the last few years, been even introduced into the French language. Thus we say *oxydule* and *oxyde* of iron instead of protoxide and peroxide of iron. In other respects every nation, with a few slight differences, has adopted the principles of the French nomenclature by each adapting them to their own language. The following table will give an idea of the chemical nomenclature in Latin, German, and English, as compared with the French nomenclature :—

Latin Names.	German Names.
Acidum sulphuricum	Schwefel-saure
Oxidum sulphurosum	Schweflige-saure
Oxidum ferricum	Eisen-oxydul
Oxidum ferrosum	Eisen-oxyd
Sulphas ferricus	Schwefelsaures Eisen-oxydul
Sulphas ferrosus	Schwefelsaures Eisen-oxyd

English Names.	French Names.
Sulphuric acid	Acide sulfurique
Sulphurous acid	Acide sulfureux
Protoxide of iron	Protoxyde de fer
Peroxide of iron	Peroxyde de fer
Protosulphate of iron	Sulfate de Protoxyde de fer
Persulphate of iron	Sulfate de Peroxyde de fer

In no language have they imagined peculiar terminations to distinguish the compounds

of metals with each other. They have preserved for these compounds the names alloys, or amalgams, when mercury enters into the compounds, which differ from true chemical compound bodies, because the proportions of their elements may vary according to circumstances.

The system of nomenclature proposed by M. Baudrimont, is founded on the knowlege (still to be determined) of molecular types. "Each numerical type should receive a name without a meaning, or taken from the history of one of the compounds by which it is furnished. This name should simply refer to a general formula, which might even afterwards be changed without the name of the type being, on that account, altered. Custom would soon identify the formula of the type with its name, and we should thus have the same name for bodies having the greatest analogy for each other. For example—ΦI^6 would represent a numerical type belonging to a great number of chemical compounds:

Az	H^3
P	K^3
As	Na^3
Sb	Cl^3
	Br^3
	I^3
	O^3
	I^3

"All the bodies taken from the same vertical series might be replaced, by each other, in such a manner that those inserted in the preceding table might thus produce nearly thirty different compounds. The series containing ammonia, which is a well known compound, might be called the *ammonide* series. To represent the derivatives of the ammonides, we might form words in the following manner:—

Azammonide, Phosphammonide, Arsenammonide, Stibiammonide } Hydric, kalic, sodic, chloric, bromic, iodic, oxyc, sulphic.

"As the ammonides can combine with other compound bodies belonging to various types, such as the chlorurets, the iodurets, &c., the resulting combinations might be called ammoniferæ, ammonacæ.

"The chlorurets would become chlorides, and we should thus have ammoniferous chlorides, and particularly ammonical chlorides."

M. Baudrimont, himself, acknowledges that this nomenclature requires great improvement to be rendered complete, for which purpose the agreement of several philosophers of different opinions would be necessary.

We shall remind our readers, also, that M. Baudrimont proposes to give the termination *osic* to certain acids formed of an acid in *ic*, and another in *ous*. Thus he proposes to call by the name of *azotosic acid*, hyponzotic acid, which in the presence of a base is decomposed, and forms an azotite and an azotate.

NOMENCLATURE OF ORGANIC BODIES.

The nomenclature as it left the hands of Morveau and Lavoisier, was rarely applied to any compound bodies, excepting those belonging to mineral chemistry. It could not have been otherwise, for all the science of the older chemists was connected, only, with mineral substances, and the dry distillation of organic bodies, over the study of which no scientific principle dominated.

If the successors of Lavoisier had chosen to tread in the footsteps of their master, organic chemistry would not at the present day have been a prey to anarchy. What was the fundamental idea that brought about a reform in the nomenclature? It was the substituting, in place of the ancient names, new terms, which might express the composition itself of the objects they indicated: and these new names, must at the same time attach themselves to a general and well-arranged system.

Lavoisier never lost sight of the fact, that "Every name of a compound body ought, at the same time, to indicate the names of the elements of that body." It was because he was unacquainted with the exact constitution of organic compounds, that Lavoisier bequeathed to posterity the task of perfecting the nomenclature of organic chemistry: the following words are admirable for their wisdom:—

"The radicals of the vegetable and animal kingdom, having not yet been well analysed, it is impossible to make them the subject of a regular nomenclature. The experiments, some of which are my own, and others executed by M. Harsenpratz, have only shown me that, in general, almost all the vegetable acids, have hydrogen and carbon as their radicals, but united in such a manner as to form but one and the same base; all these acids only differ from each other by the different proportions of these two bodies, and by their degree of oxidation. We know, also, principally by the experiments of M. Berthollet, that the radicals of the animal kingdom, and even some of those of the vegetable kingdom, possess a greater number of constituents, and that independently of hydrogen and carbon, they, also, frequently contain azote, and sometimes phosphorus, but at present there exists no accurate calculation of their quantities. We

find ourselves, therefore, obliged, after the manner of the older chemists, to give to these different radicals names derived from that of the substance from which they were obtained. Some day, no doubt, in proportion as our knowledge becomes more perfect and extensive, all these names will disappear, and will no longer exist, excepting as an evidence of the state in which chemical science was handed down to us: they will make way for those of the *hydro-carbonous, hydro-carbonic, hydrous carbon, hydric carbon, &c.*"

Lavoisier was fond of returning often to this subject, and he always expressed the same regret and the same hopes. "We must some day," he says, in another place, "be enabled to make a methodical classification of these organic substances, we know the principles of which they are composed; no doubt exists in this respect, but the proportions are, still, unknown. These considerations have determined us to retain, *provisionally*, the old names, acetic, malic, citric, gallic, sugar, gum, starch, alcohol, &c.; and even now, when I am rather more advanced in this career than I was when our attempt at a nomenclature appeared, I reproach myself for having drawn too decided consequences from experiments, which are not at present sufficiently decisive; but in agreeing to leave this part of chemistry still in abeyance, I can add the hope that it will soon be cleared up."

These words were written in 1793: a few months afterwards, this immortal chemist, who thus expressed himself on the future state of the science, expired on the revolutionally scaffold.

More than fifty years have passed since the death of Lavoisier. Let us now see how "this part of the nomenclature has been cleared up." How Lavoisier's wishes have been accomplished.

ORGANIC CHEMISTRY.

I. ACIDS.

The acids have retained their ancient names, the same names that Lavoisier only decided upon retaining "provisionally," the names of the acids, acetic, malic, citric, &c., are not derived from elements, according to the wish of Lavoisier, but from *acetum* (vinegar), *malum* (apple), *citron*, &c.; that is to say, from the substances from which these compounds are obtained.

II. BASES.

The organic bases, called also *alkaloids* (vegetable alkalies), have only been known to science for about thirty years. The names of these compound bodies, which besides carbon, hydrogen, and oxygen, almost all contain one or two equivalents of azote, are, contrary to the principles laid down by Lavoisier and Morveau, taken, in general, from the name of the substance that furnishes them. Instead of terminating in *ide*, like the inorganic bases, the vegetable alkalies are terminated by *ine*.

Examples:—

Quinine (from quinquina).
Morphine (from opium, μορφή, sleep).
Strychnine (from the fruit of a species of *strychnos*).

It is to be observed, that many other organic compounds, which, nevertheless, do not possess the properties of bases, terminate in *ine*.

III. INDIFFERENT BODIES.

There is no fixed rule with respect to these compounds, every author gives to the compound he discovers, any name he pleases. Terminations in *en* (cyanogen), *on* (mellon), *yl*, and *oyl*, are the most common. A certain number of these compound bodies act as *radicals*, a term already familiar to Lavoisier. These real or hypothetical radicals usually terminate in *yle* (from ὕλη, matter),

Examples:—

Ethyle,
Methyle.

To point out the compounds derived from the same radical, M. Laurent has employed a series of vowels, *a*, *e*, *i*, *o*, followed by the syllable *se*.

Examples:—

Pyrene (the radical),
Pyrenase,
Pyrenese,
Pyrenise,
Pyrenose.

The whole of this nomenclature, which, as we see, goes far astray from the principles laid down by Lavoisier and Morveau, is constantly receiving fresh modifications. Thus they place the particles *pyro* (πῦρ, fire) and *meta* (μετα, after) before the names of those acids, which, exposed to different degrees of temperature, acquire peculiar characters, by losing a certain quantity of water.

Examples:—

Pyrotartaric acid,
Metatartaric acid.

Other modifications are expressed by the simple transposition of one or more letters.

Examples:—

Comenic acid, a name derived, by metathesis, from that of meconic.
Itaconic, from aconitic acid.

Sometimes the simple interposition of a vowel indicates a change in the peculiar character.

Example:—

Maleic, derived from malic acid.

Isomeric modifications are marked by the Greek preposition *para* (παρά, near to).

Example:—

Paratartric, isomerous with tartric acid.

Certain acids are termed polybasic (bibasic or tribasic). In the neutral salts formed by bibasic acids, each equivalent of acid is always combined with two equivalents of the base, which are substituted for two equivalents of the water of a hydrated acid. These two equivalents of the base, may be two equivalents of the same metallic oxide, or two different oxides, or otherwise, a metallic oxide and a volatile base (water or ammonia). The tribasic acids neutralise three equivalents of the base, and each equivalent of the base, that combines with the acid, displaces one equivalent of water.—(*Liebig*).

By designating the anhydric acid by R, the metallic oxide by M O, and the water by HO, we have the following general formulæ for the organic salts formed by the polybasic acids.

I. SALTS OF BIBASIC ACIDS.

$R + 2\,H\,O$, hydrate of the acid.

$R + \left\{\begin{matrix} H\,O \\ M\,O, \end{matrix}\right.$ a salt with a fixed base, called an acid salt.

$R + 2\,M\,O$, a neutral salt.

$R + \left\{\begin{matrix} M\,O \\ M\,O \end{matrix}\right.$ a neutral salt, with two different bases.

II. SALTS OF TRIBASIC ACIDS.

$R + 3\,H\,O$, hydrate of the acid.

$R + \left\{\begin{matrix} 2\,H\,O \\ M\,O, \end{matrix}\right.$ a salt with one equiv. of fixed base (a unibasic salt).

$R + \left\{\begin{matrix} H\,O \\ 2\,M\,O, \end{matrix}\right.$ a salt with two equiv. of a fixed base (a bibasic salt).

$R + 3\,M\,O$, a salt with three equiv. of a fixed base (a tribasic salt).

$R + \left\{\begin{matrix} H\,O \\ M\,O, \\ M\,O \end{matrix}\right.$ a bibasic salt, with different bases.

$\left.\begin{matrix} R \\ R \end{matrix}\right\} + \left\{\begin{matrix} 3\,M\,O \\ M\,O^3 \end{matrix}\right.$ a double salt.

M. Dumas gives the name *conjugated* (bijugated, tri-jugated) to certain organic acids, which appear to result from the union of two or more acids. M. Gerhardt has slightly modified the primitive idea of M. Dumas, by substituting the term *copulated* for that of conjugated, and by pointing out some of the circumstances, where this particular mode of combination is applicable.

It is to be observed, that every reform and theory which has been proposed in organic chemistry, is only applicable to a certain, and frequently very limited number of facts, having no direct connection with mineral chemistry, an equally interesting part of the science. In fine, these reforms or theories do not possess the character of universality.

M. Millon professes ideas on the constitution of bases and acids which alone seem to possess the character of universality, by which every good theory is distinguished. As these ideas, which give a wonderful interpretation to facts, will perhaps some day render necessary great changes in chemical nomenclature, I think it useful to introduce in this place such of them as M. Millon has had the kindness to communicate to me.

There exist three classes of bases.

I. MONOATOMIC BASES.

First discovered, and admitted at present, in all saline combinations, they, are however, extremely rare; silver is the only metal which, under every circumstance, produces a monoatomic oxide Ag O. Other bases, such as baryta and oxide of lead, require particular conditions to furnish monoatomic oxides, Ba O and Pb O: these bases result from the union of one equivalent of metal and one of oxygen; they combine with one equivalent of acid usually forming neutral salts.

II. POLYATOMIC BASES.

These result from the union of several equivalents of metal and oxygen, or rather from several equivalents of monoatomic bases, which, being superposed, comport themselves, in their combination with acids, as a single equivalent. Thus, 3 Mg O constitutes a single equivalent of a polyatomic base; it is the same in the case of 3 Cu O, and, also, without doubt, in that of 3 Hg O, 3 Pb O, &c. These bases usually have a tendency to form acid salts.

III. HYDRIC BASES.

These result from the union of a monto-

atomic base with one or more equivalents of water. Thus, Mg O, H O; Mg O, 4 HO; Cu O, HO; Ba O, HO, form so many hydric bases; they have a tendency to combine with all their water. This union remains unaltered, particularly in the presence of weak acids.

Hydric bases have a tendency to form neutral salts, their union with hydracids is the cause of different states of the water of the salt, under the names of water of hydratation, crystallisation, constitution, &c.

There are three classes of acids:—

I. MONOATOMIC ACIDS.

These result from the union of a metal or a metalloid, with oxygen (SO^3, $Cr\ O^3$, $I\ O^5$, &c.) they combine with bases in simple proportion. The acid usually contains 1 equivalent of metal or metalloid, while the base, also, contains 1 equivalent of metal, if it is monoatomic.

II. POLYATOMIC ACIDS.

This class contains acids of the most varied constitution; first, it includes the mineral or organic acids, resulting from the union of several different acids, which have been called bibasic or polybasic acids.

This class also contains mineral acids of sufficiently irregular constitution; which combine with the same metal or metalloid.

To understand the constitution of these latter acids, it would be necessary to admit the existence in the case of each metal or metalloid of a primitive, peculiar combination, containing the greatest proportion of oxygen. Thus, sulphuric acid $S\ O^3$ for the acids of sulphur, perchloric acid $Cl\ O^7$, for the acids of chlorine; this primitive combination is a monoatomic acid. It generally agrees with an acid derivative, equally monoatomic, in which the metalloid replaces the oxygen in an equivalent proportion. Thus, $Cl\ O^7$ agrees with $Cl\ O^3$, by the substitution of 1 equivalent of chlorine for 1 equivalent of oxygen.

$$Cl\ O^7 — Cl\ O^6,\ Cl = 2\ Cl\ O^3$$
$$S\ O^3 — S\ O^3,\ S = 2\ S^2\ O^3.$$

The combination, thus modified by substitution, unites itself to the primitive combination, and forms an extremely varied series of polyatomic acids, in which we always find the same metalloid or the same metal united with oxygen, in various proportions.

III. HYDRIC ACIDS.

These acids are capable of entering into saline combinations with 1 or more equivalents of water contained in the salt. The hydrated acid forms, in this manner, a well-marked compound, even after the combination of the anhydrous acid. It is in this manner sulphuric acid, with 1 equivalent of water, forms an acid differing from SO^3, and transports its equivalent of water into several salts. Oxalic acid, in the same manner, presents two acids: $C^2\ O^3\ HO$ and $C^2\ O^3$, $3\ HO$, both of which can enter into combinations, preserving their water entirely intact.

REFLECTIONS ON THE NOMENCLATURE OF ORGANIC CHEMISTRY.

The perfecting the nomenclature of organic chemistry, was, to repeat the observation, a task bequeathed by Lavoisier to his successors. This task is still unaccomplished. Lavoisier's wishes have not been as yet realised. Notwithstanding this, analysis has made immense progress. "The proportions of the elements of compound bodies" are no longer "unknown;" yet still the old names which Lavoisier wished to banish from science have been preserved. They even seem to have fondly preserved these ancient names by abandoning the principles laid down by Lavoisier and Morveau, who wished that every binary, ternary, or quaternary compound (bodies formed of two, three, or more elements: these are Lavoisier's words,) should indicate by its name the elements of which it is composed, and even the proportions of those elements. Thus, the present nomenclature of organic chemistry is no longer that of Lavoisier and Morveau, it is the nomenclature of the alchemists—the proof is manifest. In the time of the alchemists every substance was named after some apparent physical property, or after the body from which it had its origin, or, finally, from the name of the person by whom it was discovered.

Examples:—

Turbeth mineral,
Butter of antimony,
Oil of tartar,
Cream of tartar,
Tartaric acid,
Minderer's spirits,
Powder of Algaroth, &c.

In the nomenclature of the alchemists the names never indicated the composition of substances Such is the fundamental distinction that separates, in a clear and decided manner, the modern from the ancient nomenclature, and it is a sad thing to state, that in this clearly consists the difference between the nomenclature of mineral and organic chemistry. In fact, all the names of organic compounds are either the old names which Lavoisier had retained, provisionally, or

names taken from some physical property or primitive substance.

Examples :—

Citric acid from the lemon (*citron*),
Benzoic acid from benzoin,
Quinine, quinquina.

The names alcohol, ether, gum, and sugar absolutely convey no idea to those who have neither seen nor tasted these substances. In fine, none of these names indicate the composition of the substance referred to. Thus, therefore, the nomenclature of organic chemistry is retrograde. If it is correct we ought to preserve those old names in mineral chemistry which, also, never indicate the composition of bodies. Cream of lime, colcothar, Œthiop's mineral, philosopher's wool, &c., are as appropriate as the names in organic chemistry.

The present nomenclature of organic chemistry is an insult to the memory of Lavoisier. Why have not the principles laid down by this great genius been followed, the naming of bodies according to their composition? The reason is, the method of the ancients was more easily followed. Many names, I may be told, such as sugar, gum, alcohol, ether, starch, &c., are consecrated by long usage. Be it so; but if Morveau, Lavoisier, Fourcroy, or Berthollet had been restrained by that consideration, nomenclature would never have been invented. The names of colcothar, calomel, borax, tartar, and some others, are at least as ancient as those of sugar, gum, alcohol, starch, &c. In sciences, as in other cases, genius is exhibited by boldness, united with powerful conception. Timidity and mediocrity are sisters.

Without doubt, the nomenclature of organic chemistry, which has to deal with substances, frequently extremely complex, presents more difficulties than mineral chemistry; but these difficulties were not insurmountable. Lavoisier was aware of them; and if he did not attempt to surmount them, it was because he wished that the perfection of the science itself should precede that of the language. "A nomenclature," said this philosopher, shortly before his death, "which should undertake to express at the same time the four bases of the organic kingdom (oxygen, carbon, hydrogen, and azote,) would no doubt be methodical, it would possess the advantage of expressing clear and determinate ideas. But this cumulation of Greek and Latin substantives, and adjectives, which even chemists have not, as yet, generally admitted, into use, appears a barbarous language equally difficult to remember or pronounce. Beside, the perfection of the science ought to precede that of the language, and it is necessary that this part of chemistry should reach that point at which it will some day arrive. It is therefore necessary to preserve, at least, for a time, the ancient names for animal oxides and acids."

These ancient names still remain, and others, even, have been added, which are scarcely better. Organic chemistry waits for its Lavoisier.

CLASSIFICATIONS.

We have already said, every description of nomenclature implies a classification. Every kind of classification supposes an established science. Before the time of Lavoisier there was no classification; chemistry, which consisted of a few scattered facts, without any rational connection, did not as yet exist, as a science properly so called. We will inquire in this place, whether orders, groups, or types, the result of a classification, really exist in the external world, or if they are the simple reflections of human intelligence, which constantly tend towards a unity in the variety of things. This is a question which the philosopher has agitated for more than two thousand years, without being able to resolve it. It is essentially the dispute between Plato and Aristotle in ancient times, between the nomenclature, and realism of the middle ages, and between the spiritualism and sensualism of modern times. No change has taken place, excepting in form and name, the foundation has remained the same. We shall simply confine ourselves to proving that the best classification is that which best satisfies the mind at the same time that it assists the memory, and facilitates the study of objects.

GUYTON MORVEAU'S CLASSIFICATION.*

I. SIMPLE BODIES.

Simple bodies, that is to say, those which, up to the present time, have not been decomposed, are divided into five classes.

The first includes "those principles which without presenting any marked analogy between each other have, nevertheless, that in common, which brings them more nearly to a simple state, which enables them to resist analysis, and, at the same time makes them so active in combination.

"The substances of the first class are four in number:—*Light*, *caloric*, *oxygen*, and *hydrogen*."

The second class includes "all the acidifiable bases, or radical principles of the acids. The acidifiable bases known are *azote*, *carbon*, *sulphur*, and *phosphorus*. For the unknown

* Read before the Academy, May 2, 1787.

bases, of marine acid, boracic acid, fluoric acid, &c., we are content to indicate the simple state of existence by which the oxygen they contain is modified, by the expression *acidifiable base* or *radical*.

"The third class contains the metals, namely, gold, platina, silver, mercury, copper, lead, tin, iron, zinc, antimony, bismuth, nickel, manganese, tungsten, molybdena, arsenic."

The earths occupy the fourth class, namely, silica, alumina, baryta, lime, magnesia.

The fifth class is formed of the alkalies, namely, potash, soda, and ammonia.

II. COMPOUND BODIES.

This division includes acids, bases, and salts.

The organic compounds will be found arranged in an appendix. These are distinguished as oils divided into fixed and volatile, soaps, acoholic compounds, and ethers.

This classification most certainly bears witness to the infancy of the science. Light and caloric are arranged among material, ponderable bodies. In the second class there is considerable omission. "The radicals of marine acid, boracic acid, fluoric acid," chlorine, bromine, fluorine, were still to be discovered. This *lacuna* did not escape the sagacity of Lavoisier, who even pointed out the mode of obtaining these bodies by means of "double affinities:" the fourth and fifth class of simple bodies contained only compound substances. Here, again, Lavoisier gave a proof of his profound sagacity. Several times previously, he had clearly expressed himself with regard to the "evident" composition of the alkalies. Let us now see what he said with respect to the earths. "It is to be presumed that the earths will cease to be reckoned among simple substances; they are the only bodies of this class that have no tendency to unite with oxygen, and I am much inclined to believe that this indifference towards oxygen, if I may be permitted to use that expression, arises from their being already saturated with it. The earths regarded in this light would not be simple substances, but perhaps metallic oxides oxigenated up to a certain point. After all it is but a simple conjecture I here throw out."

Finally, the errors of Morveau's classification, ought only to be attributed to the small progress chemical analysis had made at the end of the eighteenth century. Some of these divisions, however, are so clearly traced that they have been acknowledged by science, even up to the present day.

(To be continued.)

THE CHEMISTRY OF RESPIRATION.*

BY LIEBIG.

AN ANALYSIS OF THE CHEMICAL ACTIONS PRODUCED IN RESPIRATION, AND THE FORMATION OF FAT IN THE ORGANISM.

ALL the oxygenous and non-nitrogenous constituents of plants contain carbon and the elements of water; they, without exception, contain less oxygen than their carbon and hydrogen would require for their conversion into carbonic acid and water.

Oxalic acid is the only constituent of plants, which, assuming it to be anhydrous, contains no hydrogen. Many volatile oils, caoutchouc, &c., contain no oxygen.

The whole of the carbon of plants being indisputably derived from the carbonic acid of the atmosphere, and the whole of the hydrogen from water, the constituents of plants cannot have been formed in any other way than by the separation and secession of the oxygen of the carbonic acid, and the substitution of an equivalent amount of hydrogen for part or the whole of this oxygen.

An organic substance containing in one equivalent 4, 6, 12 equivalents of carbon, has derived these 4, 6, 12 equivalents of carbon from 4, 6, 12 equivalents of carbonic acid. A substance containing 4, 6, 12 equivalents of hydrogen, has derived these from 4, 6, 12 equivalents of water.

Now, viewing the constitution of carbonic acid as analogous to that of the organic acids, this acid appears to be a combination of a compound organic radical, carbonic oxide, with oxgen. The chemical deportment of carbonic oxide fully supports this view of the constitution of carbonic acid.

The following formula would accordingly express the composition of carbonic acid:—

Carbonic acid, $CO^2 = CO + O$,

CO being assumed as = 1 equivalent of the radical, which we will now designate by R, and thus the formula would be—

Carbonic acid, $CO + O = R + O$.

Now, assuming that the carbonic acid has been decomposed in the organism of the plant, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{9}$ of its oxygen having separated, this may be expressed by a formula in which the radical is represented to have increased in corresponding proportion. For instance, if the carbonic acid, for its conversion into oxalic acid, loses one quarter of its oxygen, this may be expressed by the formula—

$$C^2 O^3.$$

or by— $C^2 O^2 + O = 2 R + O$.

Assuming, further, that the oxygen of the

* *Lancet*, Sept. 5, 1846.

carbonic acid has been eliminated and replaced by the equivalents of hydrogen, we obtain compounds of different properties, according as it is the oxygen *within* the radical, or that which we assume to exist *without* the radical, that is replaced by hydrogen.

For instance: supposing the oxygen *within* the radical replaced by hydrogen, we have—

1) C O + O Carbonic acid = R + O
2) C H + O ,, = R + O,

that is, two bodies of analogous constitution, and differing simply in this, that the radical of the second is a carburet of hydrogen, corresponding to carbonic oxide.

If we assume, on the contrary, that the oxygen existing in the carbonic acid *without* the radical is replaced by hydrogen, the properties of the compound thus produced must, of necessity, differ from those of the compound produced in the former instance. If this latter were an acid, the former may be a neutral substance.

CO + O = R + O Carbonic acid.
CO + H = R + H ,,

If we assume the whole of the oxygen, both that belonging to, and that superadded to, the radical, may be replaced by hydrogen, we obtain a carburet of hydrogen analogous in composition with carbonic acid, and such as exists in reality in marsh gas.

CO + O = R + O Carbonic acid.
CH + H = R + H Marsh gas.

All organic compounds that contain carbon, and the elements of water, as being formed from carbonic acid, belong to one of the following series:—

R + O;	2 R + 2 O;	3 R + 3 O;	4 R + 4 O, &c.	Carbonic acid.
2 R + O;	..	..	..	
3 R + O;	3 R + 2 O;	..	..	
4 R + O;	4 R + 2 O;	4 R + 3 O;	..	
5 R + O;	5 R + 2 O;	5 R + 3 O;	5 R + 4 O, &c.	
6 R + O;	6 R + 2 O;	6 R + 3 O;	6 R + 4 O, &c.	
7 R + O;	7 R + 2 O;	7 R + 3 O;	7 R + 4 O, &c.	
8 R + O;	8 R + 2 O;	8 R + 3 O;	8 R + 4 O, &c.	
⋮	⋮	⋮	⋮	
34 R + O;	34 R + 2 O;	34 R + 3 O;	34 R + 4 O, &c.	

Putting entirely out of the question the views which are entertained respecting the capacity of the organic acids to neutralise bases, and to form salts with them, we have reason to believe, that all these compounds have a similar constitution to that of the organic acids; and the most natural supposition seems to be, that they contain a compound radical, of which hydrogen forms a constituent part; so that the transformation of the carbonic acid into an organic acid has been effected by the substitution of hydrogen for part, or the whole, of the oxygen in the radical. Thus, for instance, formic acid may be regarded as the first link of the (above) second series: it may be looked upon as carbonic acid, in the radical of which one half of the oxygen has been replaced by hydrogen.

The constitution of the most frequently-occuring organic acids, citric acid, tartaric acid, malic acid, and acetic acid, viewed in this way, appear equally simple.

Carbonic acid $C^2\left\{\begin{matrix}O\\O\end{matrix}\right\} + O^2 = 2\,R + 2\,O.$

Formic acid $C^2\left\{\begin{matrix}H\\O\end{matrix}\right\} + O^2 = 2\,R + 2\,O.$

Oxalic acid $C^2\left\{\begin{matrix}O\\O\end{matrix}\right\} + O = 2\,R + O.$

Malic acid $C^4\left\{\begin{matrix}H^2\\O^2\end{matrix}\right\} + O^2 = 4\,R + 2\,O.$

Acetic acid $C^4\left\{\begin{matrix}H^3\\O\end{matrix}\right\} + O^2 = 4\,R + 2\,O.$

Tartaric acid $C^4\left\{\begin{matrix}H^2\\O^2\end{matrix}\right\} + O^3 = 4\,R + 3\,O.$

Citric acid $C^{12}\left\{\begin{matrix}H^5\\O^7\end{matrix}\right\} + O^4 = 12\,R + 4\,O.$

The formulæ of acetic acid and of malic acid, it will be readily remarked, correspond to oxalic acid; tartaric acid is carbonic acid, in which one half of the oxygen of the radical is replaced by hydrogen, whilst one-fourth of the oxygen without the radical has separated.

By the action of heat, malic acid is converted into fumeric acid and maleic acid; citric acid into aconitic acid.

These conversions are effected simply by the separation of water, or by the secession of hydrogen and oxygen from the elements of the radical of the acid.

Malic acid becomes maleic acid—

$$C^4\left\{\begin{matrix}H^2\\O^2\end{matrix}\right\} + 2\,O \qquad C^4\left\{\begin{matrix}H\\O\end{matrix}\right\} + 2\,O.$$

Citric acid becomes aconitic acid—

$$C^{12}\left\{\begin{matrix}H^5\\O^7\end{matrix}\right\} + 4\,O \qquad C^{12}\left\{\begin{matrix}H^3\\O^5\end{matrix}\right\} + 4\,O.$$

In like manner, the action of heat upon acetic acid causes the separation of one equivalent of carbonic acid from the elements of that acid, and the consequent production of a neutral inflammable fluid, acetone.

$C^4 \left.\begin{matrix}H^8\\O\end{matrix}\right\} + 2\,O \left\{\begin{matrix}\text{Acetic acid is}\\\text{resolved into}\end{matrix}\right\} C\,O^2$, Carbonic acid, and $C^3 \left.\begin{matrix}H^2\\O\end{matrix}\right\}$ Acetone.

In this way, and likewise as the substitution of hydrogen for the oxygen in the carbonic acid does not take place equivalent for equivalent, but in unequal proportion, (when, for instance, upon the separation of the oxygen, both within and without the assumed radical, one equivalent of the oxygen separates without being replaced by hydrogen; or when one equivalent of hydrogen replaces two, three, or four equivalents of oxygen, which separate), new series of compounds are formed, of which the radical differs from carbonic oxide, (the radical of carbonic acid). Thus, benzoic acid and oil of bitter almonds belong to none of the above-given series; they contain a new radical, which has been formed from the radical of carbonic acid, by the separation of one-half of its oxygen, and the substitution of five equivalents of hydrogen for part of the other half.

Benzoic acid..... $C^{14} \left.\begin{matrix}H^6\\O^2\end{matrix}\right\} + O.$

Oil of bitter almonds $C^{14} \left.\begin{matrix}H^6\\O^2\end{matrix}\right\} + H.$

If we examine the formulæ of malic acid and tartaric acid, the two organic acids which are of most frequent occurrence in the vegetable kingdom, and bear in mind that they have been formed from carbonic acid, by the separation of oxygen, and the accession of a certain amount of hydrogen; if we bear in mind, likewise, that these acids are capable of further modification in the organism of the plant, from the same causes that affected the decomposition of the carbonic acid, we arrive at the natural result, that these acids, by the simple separation of a fresh amount of oxygen, must gradually lose their characteristic properties, and become converted into neutral substances, containing hydrogen and oxygen in the same proportion as these elements exist in water, and consequently in a similar proportion as they are contained in sugar, gum, starch, and woody fibre.

Two equivalents of oxygen, separating from the elements of malic acid, leave

$$C^4 \left.\begin{matrix}H^2\\O^2\end{matrix}\right\};$$

three equivalents of oxygen separating from the elements of tartaric acid, leave, likewise,

$$C^4 \left.\begin{matrix}H^2\\O^3\end{matrix}\right\};$$

and by the simple accession of $1\frac{1}{2}$—$1\frac{2}{3}$ equivalent of water, we have the composition of starch, of gum, or of grape sugar. Most of the above enumerated organic acids contain, in their radical, hydrogen and oxygen, and this either in the proportion in which these elements exist in water, or the proportion of the oxygen exceeding that of the hydrogen.

Acetic acid, and the whole of the fatty acids, contain in their radical a larger proportion of hydrogen; from acetic acid upwards, there is none containing a sufficient amount of oxygen to form water with the whole of the hydrogen present. The most frequently occurring of the fatty acids may be looked upon, in their isolated state (as hydrated acids), as compounds of oxygen with the radical of carbonic acid, in which the whole of the oxygen is replaced by its equivalent amount of hydrogen. Assumed to exist in the anhydrous state, one equivalent of oxygen would remain unreplaced in each of them.—(*Dumas.*)

Table showing the constitution of the most frequently occurring of the fatty acids:—

In the isolated state, as hydrated acids. (R = C H)		In their salts.
Butyric acid.....	$8\,R + 4\,O$..	$C^8 \left.\begin{matrix}H^7\\O\end{matrix}\right\} + 2\,O.$
Valerianic acid	$10\,R + 4\,O$..	$C^{10} \left.\begin{matrix}H^9\\O\end{matrix}\right\} + 2\,O.$
Caproic acid	$12\,R + 4\,O$..	$C^{12} \left.\begin{matrix}H^{11}\\O\end{matrix}\right\} + 2\,O.$
Caprylic acid	$16\,R + 4\,O$..	$C^{16} \left.\begin{matrix}H^{15}\\O\end{matrix}\right\} + 2\,O.$
Lauric acid .... Pichurimic acid..	$24\,R + 4\,O$..	$C^{24} \left.\begin{matrix}H^{23}\\O\end{matrix}\right\} + 2\,O.$
Carinic acid.....	$26\,R + 4\,O$..	$C^{26} \left.\begin{matrix}H^{25}\\O\end{matrix}\right\} + 2\,O.$
Ethalic acid .... Palmic acid	$32\,R + 4\,O$..	$C^{32} \left.\begin{matrix}H^{31}\\O\end{matrix}\right\} + 2\,O.$
Margaric acid.....	$34\,R + 4\,O$..	$C^{34} \left.\begin{matrix}H^{33}\\O\end{matrix}\right\} + 2\,O.$
Stearic acid	$2(34\,R) + 7\,O$	$2(C^{34} \left.\begin{matrix}H^{33}\\O\end{matrix}\right\}) + 3\,O.$

It is scarcely necessary for us to state that this table is not intended to express the exact constitution of these acids; my intention here is simply to point out their origin, their similarity of composition, and their mutual relations.

The most cursory reflection will at once show that an organic substance is to be placed the higher in the scale of organic compounds, the more its composition differs from the original type, represented by carbonic acid.

Among the neutral substances of the vegetable kingdom, dry grape sugar approaches most nearly, in its composition, to carbonic acid, although the manner of the arrangement of its elements must differ, as does its chemical deportment.

Cane sugar, gum, starch, and woody fibre appear as organic compounds of a higher order.

CANE SUGAR.

Carbonic acid.	Grape sugar.	Gum.	Starch.
$C^{12}\,O^{12}\}$ ..	$C^{12}\,H^{12}\,O^{12}\}$ ..	$C^{12}\,H^{11}\,O^{11}\}$ ..	$C^{12}\,H^{10}\,O^{10}$

If, therefore, starch is converted into grape sugar during the process of digestion, the transformation of grape sugar into carbonic acid, in the process of respiration, is effected by the simple substitution of oxygen for the hydrogen present.

In that peculiar process which we designate by the name of fermentation, a certain amount of carbonic acid separates from the elements of the grape sugar; it is obvious that the other product of this process, alcohol, must again form a representative of carbonic acid; and alcohol contains, indeed, the same number of elements as carbonic acid.

Carbonic acid.	Alcohol.
$C^{8}\,O^{8}\}$	$C^{8}\,H^{12}\,O^{4}$

The sugar has been formed in the plant from carbonic acid by the separation of oxygen, and accession of hydrogen instead. The reverse is the case in the animal organism—viz., the hydrogen is eliminated and replaced by oxygen, and it is in this way alone that the carbon re-assumes its original form. This is, generally speaking, the essential and characteristic mark of the process of decomposition or respiration; it is an indirect process of combustion, taking place at a lower temperature, and with limited excess of oxygen. We know of no instance in which the carbon of an organic compound combines, under these circumstances, directly with oxygen into carbonic acid; strictly speaking, no combustion of the carbon takes place, but the hydrogen of the organic compound is oxidised and eliminated in the form of water, whilst one equivalent of oxygen takes the place of the thus eliminated hydrogen. If one of the intermediate compounds formed by the gradual substitution of oxygen for hydrogen happen to possess an individual affinity for oxygen, several equivalents of oxygen will be required in substitution for one equivalent of hydrogen.

The evolution of heat in the process of respiration is, accordingly, not owing to the oxidation of the carbon, but to the conversion of the hydrogen of the substance into water, and the accession of one or several equivalents of oxygen in the place of the thus eliminated hydrogen.

The transformation of alcohol into carbonic acid, one of the most thoroughly studied processes of decomposition, will best serve to illustrate the process of the gradual substitution of oxygen for hydrogen.

Alcohol.	Acetic acid.
$C^{8}\,H^{12}\,O^{4}\}$	$C^{8}\,H^{8}\,O^{8}$
Formic acid.	**Carbonic acid.**
$C^{8}H^{4}\,O^{12}\}$	$C^{8}\,O^{4}\,O^{12}$

If, in the conversion of alcohol into acetic acid, there happens to be less oxygen present than is required to replace the hydrogen by its equivalent of oxygen, four equivalents of hydrogen are eliminated without being replaced by oxygen, and thus the intermediate compound, aldehyde, is formed, which changes afterwards to acetic acid by the direct assumption of oxygen.

Alcohol.	Aldehyde.	Acetic acid.
$C^{8}\,H^{12}\,O^{4}\}$	$C^{8}H^{8}\,O^{4}\}$	$+\,4\,O = C^{8}\,H^{8}\,O^{8}$

But in the presence of a sufficient amount of oxygen, aldehyde passes immediately to the state of formic acid; and in this case the four equivalents of hydrogen, eliminated in the form of water, are replaced, not by four, but by eight, equivalents of oxygen.

$C^{8}H^{8}\,O^{4}\}$ aldehyde, + 12 equiv. of oxygen = 4 equiv. of water, + $C^{8}\,H^{4}\,O^{12}\}$ formic acid.

But this is not the only form of the process of organic decomposition; there is still another and far more remarkable, form; and it is this second form which requires particular attention in studying the transformation of sugar into fat.

The fatty substances occurring in plants and animals are looked upon in chemistry as

a particular species of salts, consisting of an organic oxide, oxide of glyceryle, and a volatile or fixed acid. They possess the property in common, to suffer decomposition (saponification) by most of the metallic oxides. In this decomposition the metallic oxide takes the place of the organic oxide. Upon removing the metallic oxide by means of an acid, the so-called hydrates of the fatty acids are obtained, in which the metallic oxide is replaced by an equivalent of water.

The whole of the fatty substances which contain oxide of glyceryle yield, when heated to decomposition (in the process of dry distillation, for instance), acrolëine, a product of exceedingly pungent odour, and which irritates the eyes excessively. This product owes its formation to the oxide of glyceryle. Another characteristic property, which the whole of the volatile fat or oils have in common, besides the production of acrolëine upon heating, is the formation of a crystallisable substance, soluble in water, and which, in many respects, is similar to benzoic acid; and although differing from the latter in composition, the name of sebacic acid has been assigned to this substance. Its formula is

$$C^{10} H^{9} O^{4}.$$

Oleic acid changes afterwards into a soluble, crystallisable acid, called elaidic acid.

The composition of oleic acid is not known with certainty. Produced from oils, it attracts oxygen with the greatest eagerness and rapidity. This strong affinity for oxygen renders its production in the pure state exceedingly difficult.

The fact appearing indisputable, that the wax in the body of the bee is produced from sugar, and that the fat in the body of the graminivorous animal is produced, in the process of fattening, from starch, or, rather, from sugar (since starch is assimilable only in the form of sugar), it is perfectly certain that the transformation of the sugar into fat is possible only in consequence of a simultaneously-arising decomposition and fermentation; which means, in other terms, that the transformation of a substance rich in oxygen into one containing less of this element, is effected by the resolution of the sugar into two compounds, of which the one contains the excess of the oxygen.

As has been shown and developed in the preceding remarks, in the processes of decomposition, the oxygen combines with the hydrogen of the substance, and the highly oxygenated compounds which are eliminated in the processes of fermentation are carbonic acid and water.

According to this view, the transformation of sugar into fat takes place in consequence of the oxidation of its hydrogen, and separation of a certain amount of its oxygen, in the form of carbonic acid and water.

Upon leaving a solution of sugar to ferment, at a high temperature, in contact with putrefying cheese, excluding at the same time the oxygen of the atmosphere, a certain amount of carbonic acid and hydrogen separate from the elements of the sugar, and a fatty acid, *butyric acid*, is obtained.

It is obvious that, in the process of the formation of the same acid in the organism of the cow (which yields butyric acid in butter), the hydrogen cannot separate in a free state from the elements of the sugar, because in this process the access of oxygen is not precluded; the hydrogen combines here with the oxygen furnished by the blood, and separates them from the elements of the sugar in the form of water. The formation of caproic acid, capric acid, and the rest of the fatty acids, must take place in an analogous manner.

The following formulæ, which are intended to illustrate the formation of a few of the fatty acids from sugar, will show at the first glance that the smallness of the amount of oxygen in the fatty acid stands in direct proportion to the amount of the oxygen eliminated in the form of water and carbonic acid:—

Sugar. $C^{12} \left\{ \begin{matrix} H^{12} \\ O^{12} \end{matrix} \right\} + 4\,O =$

Butyric acid	C^{8}	H^{8}	O^{4}
Water		H^{4}	O^{4}
Carbonic acid	C^{4}		O^{8}

Sugar. $C^{18} \left\{ \begin{matrix} H^{18} \\ O^{18} \end{matrix} \right\} + 4\,O =$

Caproic acid	C^{12}	H^{12}	O^{4}
Water		H^{8}	O^{8}
Carbonic acid	C^{6}		O^{12}

Sugar. $C^{24} \left\{ \begin{matrix} H^{24} \\ O \end{matrix} \right\} + 4\,O =$

Capric acid	C^{16}	H^{16}	O^{4}
Water		H^{6}	O^{6}
Carbonic acid	C^{8}		O^{16}

Sugar. $C^{12} \left\{ \begin{matrix} H^{12} \\ O^{12} \end{matrix} \right\} + 3\,O =$

Oxide of glyceryle	C^{9}	H^{6}	O^{3}
Water		H^{6}	O^{6}
Carbonic acid	C^{3}		O^{6}

It would be an idle display of figures, to pursue these examples still further, since, for the present, we are unable to produce any other fatty acid from sugar besides the butyric acid. But it should not be forgotten, that butyric acid is really producible from sugar, and that the fatty substances are produced from sugar in the animal organism.

The solid crystallisable fatty acids belong, in respect to their constitution, to one and the same type. Analogous causes must have been active in their formation, and the manner of their action must have been similar.

The formation and production of a fatty substance from sugar cannot be imagined without a separation of oxygen in the form of carbonic acid, or a similar resolution of the sugar atom, as takes place in the process of fermentation; it cannot be imagined, without a corresponding diminution of the hydrogen, the elimination of which from the organism, in the form of water, can take place only in consequence of a simultaneously-arising process of decomposition.

In this respect, the transformation of sugar, into fat exhibits the greatest similarity with the process of decomposition of woody fibre.

A MEMOIR ON THE LAW THAT REGULATES LATENT HEAT IN FUSION; DETERMINATION OF THE TRUE ZERO, AND OF THE TOTAL HEAT IN BODIES.*

BY M. PERSON.

I HAD the honour, lately, to lay before the Academy a table giving the melting points, the latent heat, and the specific heat of thirteen substances of different descriptions.†

As to the melting points, those of the salts noticed in the table, are, I believe, determined for the first time; those of posphorus and sulphur differ from the numbers generally admitted, I have found that the point of solidification of sulphur only descends, about 110°;‡ when it has been too much heated, it is about 115°; when heated with sufficient precaution to allow the sulphur to crystallise readily, and immediately resume its usual colour.

There is great disagreement as to the melting points of metals, that for tin has been laid down as 210° C. 213, and 230; for bismuth, 256, and 283; for lead, 260, 322, and 334; for zinc, 360 and 370. That for zinc is the nearest the truth, but the highest is still 50 below the truth; as for 260° centigrade, laid down for lead in most tables, it is evidently taken from Reaumur's thermometer, forgotten to be reduced into centigrade degrees—at least, by adding 65 cen. resulting from this reduction, the error is only 12°.

The figures in the table refer to the aerometer, the determinations first made with the mercurial thermometer, having been converted by means of M. Regnault's table, which I have prolonged by the interpolation of 100°. I operated with a thermometer with a fixed zero, and reaching to 460° of which I have elsewhere spoken.

In reality, the melting point is not well known, except in the case of ice; the two or three other determinations found in the greater number of treatises on Physics, are completely erroneous. M. Gay-Lussac laid down in his course, as an approximation, numbers much nearer to the truth, but which have not been copied into other works: it was, assuming the latent heat of water as unity; 0·205 for tin; 0·22 for bismuth; 0·08 for lead, and 0·10 for sulphur.

Rudberg, by a process which M. Despretz considers incorrect, found 13·3 caloric for tin, and 5·8 for lead.

M. Despretz, in 1840, read before the Academy a memoir on the heat absorbed in the fusion of bodies, he gave no numerical results; but I found some excellent directions for the mode of operating.

The measure of the latent heat of fusion implicates that of the specific heats in a solid and liquid state; but, it is to be observed, that these quantities were unknown, in the case, of any substance, when I began my task; they are now known for thirteen bodies. The determinations of specific heats laid down in the table, are to the number of twenty-five; they were taken between temperatures varying from 30° below zero, to 444°.

If we cast our eye over the table of latent heats, we shall see that they do not follow the order of the temperatures, nor are they in an inverse ratio with the atomic weights, as it was supposed; I have found that they are connected with the temperatures of fusion, and the specific heats in the proportions—

$$(160 + t)\delta = l,$$

in which t indicates the melting heat, l the latent heat, and δ the difference of the specific heats in a solid and a liquid state. This proportion shows that, to ascertain the latent heat, it is sufficient to deduct the

* Read before the Academie des Sciences, Aug. 17, 1846.

† The table referred to will be found at the end of this article.

‡ To prevent confusion in the use of terms, the degrees of the centigrade scale are employed throughout this article.

difference from the two specific heats, as many times as there are degrees, from 160°, below zero to the melting point. In fact, if we calculate the latent heat with the results in the table, and with the specific heats determined by M. Regnault, we shall find that the formula is verified with sufficient exactness for substances whose latent heats vary from 4·7 to 79·2, and the points of fusion from 0 to 340°.

Names of substances.	Latent heat.	
	Calculated.	Found by experiment.
Water	79·20	79·25
Chloride of calcium	43·60	45·7
Phosphate of soda	59·70	54·65
Phosphorus	4·76	4·71
Sulphur	9·08	9·18.
Nitrate of soda..	63·52	62·98
Nitrate of potash	52·39	46·18

I met with a difficulty in the case of wax, which at first checked my progress: I found its specific heat in a solid state was higher than when liquid, so that δ becoming negative, the formula would produce an absurd result. But the difficulty vanished by following the progress of the specific heat connected with the act of softening. The specific heat of wax, between 38 and 12, is at least as great as that of water; between 26 and 6; it is still no more than 0·52, and only 0·39 between 2 and 20° below zero; besides, a graphic construction shows that it has a tendency to become constant. If, now, we deduct from the specific heat found between 2 and 20° below zero, as the latent heat of fusion, all that exceeds 0·39, we shall see that the formula is applicable. Now, it is very evident that the enormous increase of specific heat connected with the softening ought to be included in the latent heat. In the case of phosphorus the effect is analogous, but not so strongly marked; we may even say that, theoretically, it is the general rule: the latent heat of fusion is spread over a certain extent of the scale, an extent which for most bodies is perceptibly reduced to a point. The change in the thermometer during the action of cooling, marks these differences. Thus, for certain compound bodies there is no really fixed point during solidification: there is but a slower change in the thermometer.

I now come to the metals. I shall first observe that the heat necessary to melt them appears to be nearly in proportion to the force necessary to separate or divide their molecules, this is easily seen by comparing the melting points with the co-efficients of elasticity, or the measures of tenacity; this will explain the reason why lead has so low a latent heat.

The table of specific heats shows that that of metals is nearly the same in a solid as in a liquid state: the differences are those produced by change of temperature, without change of state.

This equality deranged my law of latent heat in a singular manner, for δ becoming equal to zero, the formula produced a false result. We cannot escape from this difficulty as in the case of wax, for in all the metals the specific heat in the solid state is taken very far from the point of fusion, and the variation with the temperature is also insignificant. As the specific heats to be measured did not extend beyond a few hundredths I thought at first that it might be only an apparent exception, arising from very supposable errors in the temperatures, which reached as far as 440° C. But, besides, that, the same exception was shown in fusible alloys, an inquiry into the errors of the processes showed me that it was impossible to admit errors of sufficient magnitude to cause their correction to make the results of the experiment agree with those of calculation. I was then convinced that the specific heat of metals was nearly the same in a solid as in a liquid state. One might have been able to have foreseen this by observing that an atom of mercury, notwithstanding its liquidity, has a specific heat scarcely greater than that of other metals in a solid state.

One would believe, after this, that it is impossible to bring the metals within the rule, but the impossibility will disappear when, instead of taking the formula empirically, we have discovered the physical interpretation it includes.

For this interpretation I remarked first, that if we agree to understand by the term degree the variation of temperature produced by the same amount of heat, it will happen that the same temperature will be indicated by different numbers in the case of different substances, but that the difference, in general, will be very small. For instance, according to Dulong and Petit's experiments, the difference will never be more than 4 degrees in an interval of 300 for various substances of different natures, solid, metallic, or non-metallic, such as glass, copper, mercury, and platina. We, therefore, take no notice of this little difference.

Now, therefore, let c and C be the specific heats in a solid and in a liquid state, $(160 + t)$; c represents the heat existing from 160° to t deg. in unity of weight in a solid state, let us add the latent heat l and we shall have the heat contained in the liquid within the same limits. Therefore, since $C - c = \delta$, it

follows that we shall have, as the result of the experiment—

$$(160 + t)c + l = (160 + t)C,$$

that is to say, that the heat that would be required to be taken from a liquid mass, to lower it to 160° below zero, can be calculated as if the mass had remained liquid, without embarrassing oneself with the changes of state.

When we consider the result of the phenomenon of superfusion, it becomes natural to believe that the liquid state is in reality compatible with the lowest temperatures, and that solidification is only an accidental accompaniment; water and phosphorus remain liquid at from 10 to 20° below their melting point; sulphur descends even lower still. I have seen drops of sulphur remain liquid on thermometers which had returned to the ordinary temperature; the contact of a feather will determine the solidification. In general, the liquid state continues to a lower point in proportion to the care we take to avoid the influence of molecular attraction; and it is natural to conclude, by induction, that, if this attraction be overcome, by isolating, for example, the last molecular groups, the liquid state would continue indefinitively. 1 kilogramme of water would continue to lose a portion of caloric at each lowering of the temperature, by a degree; and not half a portion, as in the case of ice. We may, therefore, conceive without difficulty this result of the experiment, that the heat lost from the melting point down to 160° below zero, is equal to the specific heat that agrees with the liquid state, taken as many times as there are degrees in the reduced heat.

We have seen that the formula $(160 + t)\delta = l$ is not verified in the case of the metals, it is easy, however, to see the reason. We place for the specific heat, in a liquid state, the value found above the melting point, while in reality we ought to take the value below the point of fusion. In the case of many bodies, particularly those easily subjected to superfusion, these two values are confounded; but it is not the same with metals, for which we know superfusion is scarcely sensible, probably on account of the enormous power of the molecular action. Provisionally, we cannot say that the metals form an exception to the law represented by the formula

$$(160 + t)\ (C - c) = l,$$

because the exception only manifests itself when we employ, in the place of C, any other value than that which is really represented by that letter. To confirm this explanation it is only necessary to show, at least by some indirect process, that the specific heat of metals, in a liquid state, below their point of fusion, is strikingly greater than in the solid state. Now, the fusible alloys offer phenomena which are in favour of this supposition.

One consequence of the formula is a very natural determination of the absolute zero; it is evident that the latent heat of fusion is the difference between the total heats of the solid and the liquid, at the melting heat; now the formula has shown us that it is also the difdifference of the continuous heats from 160° below zero. This result is simple if the absolute zero is 160° below the ordinary zero; while, if we imagine that it is lower, we are forced to admit, without seeing any reason for it, that at 160° below zero the heat in the liquid state is precisely the same as in the solid state. Besides, when we see that the continuous heat in the liquid can already be represented, to 160° below zero, by $(160 + t)$ C, we can scarcely refuse to extend this formula further, so that, if, instead of 160° we place the distance x of the ordinary zero at the absolute zero, we have $(x + t)$ C, for the total heat of the liquid: we have even $(x + t)\,c$ for that of the solid, and, consequently, $(x + t)\,\delta = l$, because the latent heat, l, is the difference of the two total heats. Now, this equation compared with the result of the experiment represented by $(160 + t)\,\delta = l$ gives $x = 160°$.

It is generally believed that the latent heat of fusion is a constant quantity; it is, on the contrary, infinitely more probable that it varies with the latent heat of evaporation, according to the temperature or change of state produced. Let us imagine 1 kilogramme of ice at — 20°, it is necessary to raise it to zero to impart to it 10 of caloric, and afterwards 79·2 to melt it—in all 89·2. Act how we will, it is always necessary to restore it to its primitive state, to remove all the heat we have bestowed upon it. If, now, we operate by superfusion, the water in cooling 20° loses 20 of caloric; it can, therefore, only disengage 69·2 in becoming solid: such would be the latent heat of water at — 20°. It is also evident that this would give the formula, $(160 + t)\,\delta = l$, when we make $t = -20°$.

In order that the latent heat should remain constant, it would be necessary that the water, still preserving its liquid state, should suddenly experience a reduction of one-half in its capacity for heat, which is not at all probable. Besides, the study of fusible alloys furnishes a fresh proof of this variation of the latent heat.

On this account, I consider latent heat as the difference between the continuous heats in the solid and liquid, at the tempe-

rature, be it what it may, at which it becomes solid. This is expressed by the formula $(x+t)\ \delta=l$, where x indicates the distance of the absolute zero from the ordinary zero. Now, since experiment gives $(160+t)\ \delta=l$, and, as l is the same in both cases, that x should be equal to 160°, is a necessary consequence.

The distance of the absolute zero from the zero of melting ice, being given in degrees of equal capacity, and the ordinary degrees being nearly of equal capacity, through a great portion of the scale, it follows that we have a measure of the total heat of a solid or liquid body, by the very simple formula $(160+t)\ c$; t being the temperature of the body, and c the specific heat; in the case of metals, in a liquid state, we have to add the latent heat l. This formula will, I hope, be applied in researches into the heat produced by chemical action, we cannot measure the heat really produced, if we do not know the total heat, excepting in the very peculiar case where the capacity of the compound would be the mean of the capacity of its constituents.

The total heat of vapours at the boiling temperature, may be calculated by adding the latent heat l. The latent heat of evaporation may also be considered as the difference of the total heats of the liquid and the vapour, at the temperature when the conversion into vapour takes place; so that, if we represent by δ, the mean difference of the specific heats of the liquid and the vapour, we have $(160+t)\ \delta=l$. The following table will give the results of calculation for bodies whose specific heat is known when in a liquid state, and the heat when converted into vapour, at least approximatively, at the temperature t of ebullition, under a pressure of 0·76m.; we refer here to atomic weights.

Names of substances.	T	L	Latent heat.	Δ
Sulphuric ether	35·7	426	898	2·17
Sulphuret of carbon..	46·6	502	719	2·42
Wood spirit.....	66·5	582	866	2·56
Alcohol	78·8	597	1024	2·50
Water	100·0	602	892	2·31
Essence of turpentine	156·8	653	1764	2·06
Sulphur	316·0	724	1392	1·52
Sulphuric acid.....	326·0	748	1791	1·53
Mercury	350·0	775	988	1·52

We may observe that δ varies but little, and that its variation is regular. As to the total heat, it is nearly the same in several vapours, differing much in composition and temperature, but offering the common character of possessing the same elastic force.

To sum up all, the present paper submits to the judgment of the Academy—

1. The correction of several melting points, and a fresh determination of them.

2. The measure of the latent heat of fusion, for thirteen substances.

3. Twenty-five determinations of specific heat, at temperatures extending from 30 to 440°.

4. The rule $(160+t)\ \delta=l$. That is to say, that the latent heat of fusion, is equal to the difference of the two specific heats, taken as many times as there are degrees between the temperature of fusion, and 160° below zero.

5. The observation, that the heat necessary to melt metals is nearly in proportion to the force required to separate or divide their molecules.

6. The result, that the specific heat of metals is nearly the same in the solid as in the liquid state.

7. The principle that the heat contained in a liquid, from its melting point to 160° below zero, is expressed by $(160+t)$ C, as if there had been no change in its state.

8. The determination of the absolute zero, 160° below the ordinary zero.

9. The principle that latent heat is a quantity varying with the temperature at which solidification takes place.

10. The other principle, that solidification, at the time of cooling is a contingent, and not a necessary phenomenon, so that the liquid state, and even the gaseous state would be compatible with the lowest temperature.

11. A measure of the total heat of a body which is applicable to solids, liquids, and vapours.

12. The result, that the water of crystallisation in salts, would possess nearly the same specific heat, and the same melting heat as ice, so that, to melt a hydrated salt, there would be required at least as much heat as would be necessary to melt a weight of ice equal to that of its water of crystallisation.

LATENT HEATS OF FUSION.

Names of substances.	Fusing Point.	Latent heat of the unity of wt.
Tin	235°	14·3
Bismuth	270	12·4
Lead	332	5·15
Zinc	423	27·46
Arcet's alloy, Pb^2 Sn^2 Bi^3	96	5·96

LATENT HEATS OF FUSION.

Names of substances.	Fusing Point.	Latent heat of the unity of wt.
Fusible alloy, Pb Sn^2 Bi.....	145°	7·63
Phosphorus	44·2	4·71
Sulphur	115	9·175
Nitrate of soda	310·5	62·98
Nitrate of potash ..	339	46·18
Phosphate of soda, P^2 O^5 + 2 Na O + 24 H^2 O.....	36·4	54·65
Chloride of lime, Cl^2 Ca + 6 H^2 O..	28.5	45·79
Yellow bees' wax ..	62	43·51

SPECIFIC HEATS.

Names of substances.	Temperatures between which the specific heat was taken.	Specific heat.
Tin	340 and 240	0·061
Bismuth	370 ,, 280	0·035
Lead	440 ,, 340	0·039
Arcet's alloy	300 ,, 136	0·036
Idem	136 ,, 107	0·047
Idem	80 ,, 14	0·060
Idem	50 ,, 12	0·049
Fusible alloy, Pb Sn^2 Bi.....	330 ,, 143	0·046
Phosphorus	100 ,, 50	0·212
Sulphur	147 ,, 120	0·235
Nitrate of soda	430 ,, 330	0·413
Nitrate of potash ..	435 ,, 350	0·344
Phosphate of soda ..	79 ,, 44	0·758
Idem	2 ,, 20	0·454
Chloride of lime....	127 ,, 100	0·519
Idem	100 ,, 60	0·562
Idem	60 ,, 31	0·358
Idem	28 ,, 4	0·647
Idem	2 ,, 20	0·406
Yellow bees' wax ..	102 ,, 66	0·54
Idem	58 ,, 42	1·72
Idem	42 ,, 26	0·79
Idem	26 ,, 6	0·52
Idem	2 ,, 20	0·39
Ice	0 ,, 30	0·505

ON THE EMPLOYMENT OF THE SULPHOCYANIDE OF POTASSIUM AS A TEST FOR ASCERTAINING THE PURITY OF NITRIC ACID.*

BY T. KIPP.

The extreme sensitiveness of the sulphocyanide of potassium as a test for peroxide of iron, led to its being employed for detecting iron in nitric acid. Tromsdorff, however, observed that sometimes a nitric acid, prepared from the purest materials, exhibited the reaction of iron. To ascertain more closely the reason of this phenomenon, the author prepared nitric acid,—1st, from ordinary *aqua regia*, freed from muriatic acid by nitrate of silver containing copper, and then slowly distilled; 2nd, according to the method described by Wackenroder; and 3rd, by employing pure sulphuric acid and pure nitre. The acid so obtained had the specific gravity 1·260—1·30; it was clear, and was not affected by sulphuretted hydrogen. A single drop of a solution of sulphocyanide of potassium gave, however, a more or less reddish colour to all three preparations, the weakest being the least coloured. The acids were now saturated with carbonate of ammonia, when they remained perfectly clear; and in none of them was any alteration perceptible on the addition of prussiate of potash, sulphuretted hydrogen, or sulphocyanide of potassium. Upon this the author prepared a nitric acid which contained $\frac{1}{50000}$ peroxide of iron, and treated as above. On saturation, the liquid assumed a light yellow colour, and presented a very slight trace of sediment. Prussiate of potash coloured the suspended particles of peroxide of iron blue; sulphocyanide of potassium, however, did not produce the slightest alteration, although the presence of the iron had been rendered perfectly distinct by it before saturation. Rose states, in his "Manual of Analytical Chemistry," that the red colour which is produced by sulphocyanide of potassium in liquids containing peroxide of iron again disappears, after a time, on the addition of more nitric acid.

In Berzelius' work we find, that when a solution of sulphocyanide of potassium is mixed with nitric acid and heated, a yellow body is formed, which has great similarity to the so-called sulphuret of cyanogen, but contains 1 equiv. sulphur more. On observing more closely the decomposing action of nitric acid upon the sulphocyanide of potassium, the author was not only able to confirm the statement of Rose, but he found, on the first addition of the acid, that the red colour of the sulphocyanide increased in in-

* *Archiv der Pharm.*, and *Chem. Gazette.*

tensity, and, on its slow disappearance, an evolution of gas took place, upon which the liquid assumed a light greenish tint. When the nitric acid was mixed with a little more sulphocyanide of potassium, the liquid remained almost colourless for some time; subsequently, however, it became red, and bubbles of gas were given off, upon which the liquid again exhibited a green colour. On the addition of a persalt of iron, the red colour could not be reproduced; but on the addition of a further quantity of sulphocyanide, the liquid not merely became bright red, but a violent evolution of nitrous vapours resulted, so that both the sulphocyanide of potassium and the nitric acid must have been decomposed. The author now mixed a few drops of the first hydrate of nitric acid with some water until the specific gravity was 1·07, and then added some sulphocyanide of potassium, when it immediately assumed a bright red colour. After the author had boiled a portion of the acid, he again added some sulphocyanide, but no colouring ensued. It is evident, therefore, that the decomposition of the sulphocyanide of potassium must have been produced by nitrous acid, which was also confirmed by the fact, that when the nitric acid had been previously freed entirely from nitrous acid by chromate of potash, peroxide of lead, &c., it required a considerable length of time before it became coloured by sulphocyanide of potassium. What the red body may be cannot yet be determined, but from the above experiments it results, that the acid must not be too concentrated for the peroxide of iron to to be detected in it; that it must be in slight excess, but free from nitrous acid.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE MANUFACTURE OF ARTIFICIAL ULTRAMARINE.*

BY M. C. P. PRUCKNER.

MM. Guinet and Robiquet were the first persons who manufactured artificial ultramarine on a large scale, for commercial purposes: in 1830, Levercus established a manufactory in the environs of Cologne, and in 1841, MM. Leykauf Heine and Co., set up works for the manufacture of artificial ultramarine, where ultramarine of every quality and price is produced for commercial purposes.

The process employed by these gentlemen has not been published; in consequence however of our personal dealings with them, and the experiments which they suggested to us, we are enabled to give an idea of the manufacture, by which we hope to throw some light upon this branch of science.

We will first say a few words upon the choice of the primary substances to be employed, which are argil or potter's clay, sulphate of soda, sulphur, coal, or charcoal, and a salt of iron, generally green vitriol (protosulphate of iron).

The argil employed in manufacturing artificial ultramarine has the greatest influence upon the colour to be produced; and probably in a great many instances failure is to be attributed to the employment of clay of too ferruginous a nature.

I use a white clay which is not coloured by fire, and which consequently contains but very little iron. It is a species of kaolin, of a dead colour, biting to the tongue, and forming a very short paste with water, and is to be met with in the principality of Reuss, in the environs of Roschitz, being generally used for making porcelain. This clay contains from 42 to 43 per cent. of alumina, and it will readily be conceived that the preference ought to be given to the most aluminous clay.

In the manufactory at Nuremberg, a white terra sigillata (called *bolus alba* in pharmacy), which comes from Tischeureuth, is employed.

At Nuremberg impure sulphate of soda is employed, which is the residuum from the manufacture of hydrochloric acid, and which may either be refined in the works, or purchased in a refined state; this operation, which will be referred to hereafter, is intended principally to separate the free hydrochloric acid and the salts of iron, which would injure and might even entirely destroy the blue colour of the ultramarine obtained: roll or stone brimstone is too well known to require any notice.

With regard to the coal or charcoal to be employed, dry wood charcoal appears to be that best adapted to the purpose.

* *Erdman's Practical Journal of Chemistry.*

Coal is also employed sometimes, and in that case it is to be chosen dry, rich in carbon, and giving the least possible quantity of white or grayish ash; and non-ferraginous.

The calcination of the mixture is effected in muffles placed in reverberatory furnaces, as it is much easier by this means to regulate the temperature and watch the operation than by using crucibles. They are constructed of refractory fire-clay, in the same manner as glass pots, and may be closed in front by a cast-iron door, which, as well as the bottom, is furnished with a narrow slot, for watching the operation, and admitting air. The furnaces are furnished with registers, which allow the temperature to be regulated at pleasure. The duration of the muffles may be increased by supporting them upon three rows of bricks, placed upon the bed of the furnace, and at certain distances apart, in order to allow of the passage of the flame, and thus divide the furnace as it were into two furnaces. When wood charcoal is employed as fuel it may be charged through a door at top, as in assay furnaces.

Besides the muffle furnace, for the conversion of sulphate of soda into sulphate of sodium, a furnace analogous to those employed in the manufacture of soda is employed. In my works, I have substituted for the single lateral fire-place, two smaller ones, placed opposite each other. Experience proves that a considerable saving of time and fuel is effected by this means, especially in furnaces the beds of which are more than 6 feet in length. The construction of these furnaces is so well known that it will be unnecessary to enter into any further details thereupon.

Lastly, the works must contain stampers and mills for pulverising substances, &c.

We will now proceed to the preparation of the primary substances, and to the manufacture of the artificial ultramarine.

The clay having been broken to pieces with a wooden pestle is put into rectangular vessels six feet long and three feet wide; it is then to be sprinkled with water and left alone for some days, until reduced to a pasty mass, which is purified by levigation and deposition, in the same manner as in porcelain manufactories, in order to separate the sand and the grosser parts. It is afterwards kept in vessels placed under a covered shed in the state of a soft paste, the quantity of dry clay contained in which is to be correctly ascertained each time it is to be used for the preparation of ultramarine.

In order to prepare the sulphate of soda, the residuum from the manufacture of hydrochloric acid is employed, as already mentioned; this is to be calcined in a reverberatory furnace to drive out the free acid contained therein, and is afterwards broken into pieces, and plunged into water for an instant (it having been proved by experience that the free acid is disengaged much more easily from a damp salt than from a dry one); the pieces are then piled upon the bed of the furnace, nearly up to the arch, and arranged in such a manner that the flame may circulate freely over them. The furnace is then gradually heated to a dull red, until all the free acid has been driven off.

The calcined salt is then pulverised, either with a stamper or between stones, into grains of the size of gunpowder, and mixed in a vessel turning on an axis, with coal and slacked lime in the following propertions:—

Sulphate of soda....	100 parts.
Powdered charcoal ..	33 do.
Slacked lime.....	10 do.

This mixture is introduced on the bed of the reverberatory furnace, and covered with slacked lime, which is thrown upon it with an iron shovel; the furnace is then closed, and as soon as the mass is in a complete state of fusion, it is briskly stirred by projecting upon it several shovelsfull of powdered coal or charcoal; it is then left quiescent for some time, until no more lighted gas is disengaged from the surface of the bath. The sulphuret of sodium is poured out into flat cast-iron moulds, where it is solidified.

The sulphuret of sodium, mixed with carbonate of soda, is dissolved in boiling water; the solution is then left to clarify, and kept from contact with the air in suitable vessels, where it parts with some of the carbonate and a little sulphate of lime; sometimes a little crystallised sulphate of soda, which is calcined and treated as above described, and very fine coal or charcoal, which is not deposited until after some few days. It is very important to leave it quiescent as long as possible, because the least particles of coal are sufficient to change the colour of the ultramarine in the fire. This solution, after being decanted, is saturated with powdered sulphur, and concentrated by boiling, until it contains 25 per cent. of dry bisulphuret of sodium; it will then be of a density of about 1·200, and mark 25° of Baumé's aerometer: from 40 to 50 parts of sulphur are employed for 100 parts of simple sulphuret of sodium in a state of fusion.

Having allowed the slight excess of sulphur contained in the sulphuret of sodium to deposit, it is transferred into large glass bottles, which are carefully corked, to keep it from contact with the air, and it is thus kept until it is wanted.

The substances being prepared, the manu-

facture of the ultramarine is proceeded with; 100 lbs. of the sulphuret of sodium, above mentioned, are evaporated to the consistence of syrup in a flat cast-iron boiler; a quantity of washed clay, still damp, corresponding to 25 lbs. of dry clay, is added, and the whole is mixed as intimately as possible with a strong iron spatula. Whilst the mass is still capable of being easily stirred, a solution of 250 grammes of crystallised sulphate of iron, quite free from copper is added, and the whole is mixed with the greatest care; if preferred, the solution of iron may be added first, and the clay afterwards. On the addition of the sulphate of iron, the mixture assumes a yellowish-green tint, owing to the formation of sulphuret of iron; it is stirred until evaporated to dryness, and reduced to as fine a powder as possible.

The muffles are charged with a layer of this powder, from two to three inches thick, which corresponds to a weight of from 30 to 40 lbs. for each muffle. The fire is continued until the whole mass attains a red heat, and it is left in this state from three quarters of an hour to an hour—the surfaces being frequently renewed and free access given to the air. The mass assumes, successively, a yellowish-brown, red, green, and finally blue colour. This operation requires much attention and practice; if the heat be not sufficiently high, the ultramarine will not be produced, and if too high and too long kept up the beauty of the tint will be deteriorated.

The charge is now withdrawn from the muffle, and washed with water. This water, which, after washing, contains sulphuret of sodium, sulphate, and sub-sulphate of soda, has not as yet been employed for any purpose; it might, however, be used for the preparation of sulphuret of sodium. The residuum after washing, is drained in a strainer of very fine texture, and afterwards dried: the colour is ordinarily a green or blackish-blue. The dried mass is then finely pulverised and sifted through silk, and afterwards calcined in portions of from 10 to 14 lbs. in muffles made especially for the purpose, and which are from 16 to 18 inches wide, and from 30 to 40 inches deep. A moderate fire is kept us, and a gentle red-heat suffices to produce the desired colour. As soon as the blue colour begins to appear, the contents are stirred with an iron rod, until it becomes a fine blue. The operation lasts from half an hour to three quarters of an hour: there is no advantage in prolonging it, or increasing the intensity of the fire. The powder is then taken out of the muffles and allowed to dry in the open air on slabs of granite; and it often happens that, in drying, the colour acquires much more fire and beauty.

The ultramarine is then ground between granite stones, about 3 feet in diameter, and afterwards washed and separated into various degrees of fineness, numbered respectively $\frac{1}{2}$, 0, 1, 2, 3, 4, &c.

An excellent test of the quality of ultramarine is to heat it over a spirit lamp, in a glass tube, through which a current of hydrogen is passed. The quality of the ultramarine is in proportion to the length of time the blue colour takes to disappear. Natural ultramarine colour does not lose its colour for one or two hours, and sometimes more; artificial ultramarine of Nuremberg, marked 0, in the space of half an hour; and the most inferior marked 5, in a few minutes.

ON THE PRECIPITATION OF GOLD IN THE METALLIC STATE.*

BY. M. BARRAL.

In the memoir which I have the honour to lay before the Academy, I have examined what are the conditions on which the precipitation of gold in the metallic state on the different ordinary metals in a continuous and adherent layer depends. The solution of gold on which I have experimented is the alkaline bath of Mr. Elkington, and the simple immersion is effected in the same way as is practised in gilding by the moist process. Struck with the obscurities which still surrounded the explanation, I first sought to dispel them. The Academy will no doubt remember that Messrs Wright and Elkington supposed that on boiling the perchloride of gold in presence of a large excess of bicarbonate of potash and organic substances, this salt was reduced to the state of protochloride. M. Dumas, in his important report on the processes of gilding of Messrs. Elkington and Ruolz, regarded this explanation as probable, and admitted that, in the gilding of brass by the moist way, the chlorine of the protochloride of gold seizes hold of 1 equiv. of copper, while 1 equiv. gold is precipitated. M. Figuier has denied this explanation in his memoir of the oxygenised compounds of gold, purple of Cassius and fulminating gold. He asserts that the protoxide of gold is precipitated as fast as it is formed, and constitutes the black deposit which is always observed at the bottom of baths in action; and he maintains that an oxide of gold is formed, containing more oxygen than auric acid, of remarkable instability and eminently suited for the deposition of gold. Thus, on the

* *Comptes Rendus*, and *Chemical Gazette*.

one hand, reduction of the gold and gilding by the salt at the minimum state of oxidation; on the other hand, superoxidation of the gold and gilding by the higher oxide. These are the two opposite theories, between which the balance alone can decide.

I formed a bath containing a known quantity of gold, and gilded with it a certain number of objects, then analysed the solution and the black sediment collected at the bottom, and readily found, that both in the bath, as well as in the black precipitate, there was a quantity of copper equal to Cu^2, while Au^2 had been precipitated. This result leads me to conclude, that the agent in the gilding is either the protochloride of gold, and the reaction $Au^2Cl + 2Cu = Cu^2Cl + Au^2$, or the unknown chloride of gold intermediate between the proto- and perchloride, for we might equally well have $Au^2Cl^2 + 2Cu = 2CuCl + Au^2$.

In the black precipitate, considered by M. Figuier as the protoxide of gold, and by other chemists as pulverulent metallic gold, I have found on analysis carbonate of lime, oxide of copper, and purple of Cassius. Carbonate of lime was derived from the water and the bicarbonate of potash employed, and the purple of Cassius from the tin forming the solder of the gilt articles.

On examining the solution after the gilding, I found, as M. Figuier had done, that the gold in it was in the state of a higher chloride or oxide, and I have shown that the gilding is independent of the mixed organic substances, and that the potash only acts an unimportant part, that of absorbing the excess of chlorine. I have thus been led to continue the bath as it were indefinitively, which hitherto had only been employed for one operation. Perchloride of gold is added in proportion as the bath becomes exhausted until the whole of the potash is converted into chloride of potassium and chlorate of potash; the bath is then again rendered efficacious by adding to it bicarbonate of potash. The reaction exerted on the chlorine by the potash only takes place at the moment of the gilding, and is clearly explained by the following equation:—

$$6Au^2Cl^3 + 6KO + 12Cu = 12CuCl + 5ClK + ClO^5KO + 6Au^2.$$

As gilding by immersion is nothing more than a chemical reaction, founded on Bergmann's law of the precipitation of metals, and like every chemical action liberates electricity, I was led to think that it would be possible to gild by immersion almost all the metals to any thickness, profiting by this liberated electricity. Some experiments on the gilding of silver by M. Normand, and the researches of M. Frankenstein on electro-chemical gilding by the action of a single pair, without the employment of a diaphragm, in baths employed for gilding by the battery, pointed out the possibility of realising this idea.

From the experiments made by M. d'Arcet on gilding by mercury and by the moist way, executed by professional gilders, M. Dumas was led to state that the best gilding by the moist process, having fixed 0·0422 grm. gold to the square decimetre, and the worst with quicksilver, having taken 0·0428, it is evident that gilding by the moist process scarcely attains, in the most favourable case, to the degree of thickness which the worst gilding with quicksilver necessarily attains. I at first thought that if the gilders who executed the specimens examined by M. d'Arcet had allowed them to remain for a longer time in the bath, they would have acquired a thicker layer of gold; experiment has shown that the maximum thickness which it is possible to attain in gilding by the moist process had not been realised. This result agrees with that obtained by M. Becquerel, in his researches on the influence of polishing the surface in gilding by the moist process; and I have confirmed the principle, that plates of copper, polished with the greatest care, are precisely those which take the least gold.

Thus, on the one hand, but a very thin layer of gold is deposited by immersion on a well-polished surface, evidently because the deposited gold being in a continuous and highly-adherent layer, the copper can no longer dissolve; and, as we have shown in our memoir, Au^2 is only precipitated in proportion as Cu^2 is dissolved. On the contrary, a badly-polished surface, but well-tempered and cleansed, so as not to be protected from chemical action, by a layer of grease, may be coated by immersion with a layer of gold, the thickness of which is solely limited by the quantity of gold contained in the solution; because the deposited gold being in an interrupted and frequently non-adherent layer, the exposed copper can dissolve, and Au^2 is precipitated as long as there is any Cu^2. This being established, let us immerse at the same time some well-polished and some badly-polished copper, connected by a copper wire, in Elkington's bath. The last copper will produce a chemical action, a pulverulent deposit of gold, a permanent solution of copper, and lastly a galvanic current. On the first copper there will be at the commencement a deposition of gold by the ordinary law of metallic precipitation, and subsequently a deposit of gold, due to electro-chemical action; for the badly-polished copper becomes the positive pole, and the

well-polished copper the negative pole, of the voltaic element thus constituted.

I have succeeded, according to this principle, in gilding to any thickness, with the most beautiful tints and colours, copper, silver, platina, iron, and lastly *gold* itself, in Elkington's bath, by the simple immersion of the metals in the presence of copper, zinc or lead.

IMPROVEMENTS IN SEPARATING METALS FROM EACH OTHER, AND FROM CERTAIN COMBINATIONS WITH OTHER SUBSTANCES.*

BY JOHN TAYLOR.

THIS invention relates to the separation of silver from ores or metallic combinations containing that metal, which the patentee proposes to effect by either of the two following methods:—Firstly, by forming a chloride of silver, then dissolving it by any of the solvents hereafter mentioned, and afterwards precipitating the silver from the solution; or, secondly, by converting the whole, or as much as is practicable, of the silver, contained in an ore or regulus, into a sulphate of silver, by a process of calcination, and then dissolving the sulphate of silver in hot water—the other metals contained in the ore being rendered insoluble.

The argentiferous materials to be treated according to the first part of this process may be divided into two classes: those containing sulphur, and those which do not contain sulphur. As regards the sulphurous material, if it be a regulus of copper or iron, the patentee prefers first to granulate it, by allowing it, when in a hot state, to flow into water; it is then calcined in a furnace similar to those used for calcining copper regulus, for from twelve to thirty-six hours, according to the nature of the regulus under operation and the quantity in the furnace; after which it is ground, and passed through a fine sieve: during the calcination a moderate fire should be kept up, sufficiently low to prevent the regulus from caking; and the material should be stirred every two hours. The object of this process is to evaporate a portion of the sulphur, and thus almost entirely prevent the caking of the material in the subsequent calcination. In the same manner, sulphurous ore, which it might be inadvisable to melt, from its being already sufficiently rich in silver, and needing no concentration, would be most advantageously treated by calcining it as above described, previous to grinding, in order to prevent the formation of lumps in the subsequent calcination.

The operation of calcining the ore or regulus, after the above treatment, is carried on in a simple reverberatory calcining furnace; the heat, on the introduction of every fresh charge, should be moderate, and gradually increased to a bright red heat, approaching yellow; the operation generally lasts from two to three hours, and during this time the material must be constantly raked, for the purpose of thoroughly oxidising the copper, iron, and other metals contained in the ore or regulus. The state of the material operated upon should now be tested, by withdrawing a small portion of it, and, while still hot, pouring water upon it; if the water is then colourless, the material has been sufficiently calcined; but if the water should be blue or green, the calcination must be continued. When the sulphates of of copper and iron have been decomposed, chloride of sodium, or any other suitable chloride, is to be added, in the proportion of four or five parts of salt to one hundred parts of the substance treated; the heat of the ore or regulus should be reduced previous to the addition of the salt, in order to prevent too great evaporation and loss of chlorine; and on the salt being added, the material should be well stirred for some time, and a degree of heat maintained sufficient to cause the chlorine or muriatic acid to rise in almost invisible fumes, in which the material should be allowed, as it were, to soak. The material may now be again tested, to prove whether the calcination has been thoroughly performed, by withdrawing a small portion from the furnace, and pouring over it a hot saturated solution of chloride of sodium; if the solution, thus obtained, be clear and colourless, and becomes of a whitish colour when cold water is added, the calcination is complete; but if the solution is blue or green, the calcination must be continued. The operation may be hastened by strewing over the material in the furnace another half pound or pound of common salt for every hundred pounds of the material; and the whole must be constantly stirred. So great is the affinity of silver for chlorine, that it has been found sufficient, in many instances, to rake the material which has been calcined out of the furnace, and mix it with salt, while hot; and chloride of silver has been thereby produced.

If the ore or regulus does not contain any sulphur or other substance which it is necessary to volatilise or oxidise by the above calcinations, common salt, in the proportions before given, may be at once added, and the

* *Newton's Journal of Arts.*

material placed immediately in the furnace, and treated in the manner above described, for producing a chloride of silver, beginning from the point at which the common salt is added.

A chloride of silver having been thus formed, the ore or regulus is to be washed or lixiviated with a hot saturated solution of chloride of sodium or other suitable chloride, or with a solution of hyposulphate of soda, potash, or other alkali or earth, which will dissolve the chloride of silver, and thus separate it from the insoluble portions of the ore or regulus. From this solution the silver may be precipitated by any of the known methods;—precipitated copper may be used with advantage for effecting this operation. If the material thus treated has been copper regulus, some chloride of copper will remain in the solution, as also if copper has been used for precipitation; in this case, the solution from which the silver has been precipitated may be introduced into vessels containing iron, free from oxide, and the copper will then be thrown down, together with any silver that may have remained in the solution; and the copper thus obtained may be employed for precipitating the silver, as above mentioned. If it be desired to economise the salt used in this process, the lixiviated residue may be further washed, and the liquor preserved, together with that obtained from the precipitation; and, after being brought up to the point of saturation, it may be again employed for the extraction of further quantities of silver.

The second part of this invention is carried out in the following manner:—If the material to be treated is a sulphurous ore or regulus, it is to be subjected to a preparatory calcination, as in the treatment of ore or regulus for forming chloride of silver; in fact, this part of the invention may be considered to begin when the ore or regulus has been finely pulverised, after its calcination. The ore or regulus is then placed in a calcining furnace, in which it is acted upon by a current of atmospheric air, and is kept constantly raked; this operation generally lasts about three hours, commencing at first with a moderate heat, and gradually increasing to a full red heat, approaching yellow. During the operation the state of the material must be constantly tested by withdrawing a small portion from the furnace, and pouring water upon it whilst hot, or else hot water must be used; a few grains of common salt must then be added, and if the operation is not complete, the solution, which was at first green, will be changed by the salt to blue; when only a small portion of the silver has been formed into a soluble salt by the calcination, it will simply cloud the solution when salt is added; but when the calcination is complete, the chloride of silver will be thrown down in thick white flakes on the addition of salt. The material being now removed from the furnace is lixiviated with boiling water, and the silver is precipitated from the solution by any of the known methods.

Sulphurous ore or regulus may also be treated in a calcining furnace, after being pulverised, without any previous calcination; in this case, a very slow heat must be employed for the first part of the process, during which time the sulphur, contained in the ore or regulus, undergoes combustion; when the combustion ceases, the process above described, for converting sulphuret of silver into sulphate, begins.

If it be desired to treat an ore by the sulphate process which does not contain any sulphur, and at the same time inadvisable to convert it into a regulus, a small portion of sulphur in any shape, such as sulphurous copper ore or iron pyrites, may be mixed with it, so as to afford sufficient sulphur to combine with the silver; and the ore may then be calcined as before directed,—particular attention being paid to the test.

The lixiviating apparatus employed by the patentee consists of a round tub fitted with a strainer composed of a perforated disc of wood, and a disc of basket-wood, covered with linen; and tow is packed round the sides, between the strainer and the tub.

INFRINGEMENT OF A PATENT PROCESS FOR MANUFACTURING SULPHATE OF SODA AND MURIATIC ACID.*

GAMBLE *v.* KURTZ.†

THE action had been tried before Mr. Justice Coltman at the sittings after last Hilary Term, and was brought for the alleged infringement of the plaintiff's patent in a certain apparatus for the production of sulphate of soda and muriatic acid. The pleas put in by the defendant were, first, not guilty; secondly, that the plaintiff was not the inventor of the apparatus; thirdly, that the invention was not new, as described in the specification; together with several others, not material to mention here. At the trial it was proved that common salt and sulphuric acid were the agents used in the apparatus in question; the effect of bringing the acid into contact with

* *Newton's London Journal.*

† Judgment of the Court of Common Pleas, July 6, 1846.

the salt being to produce therefrom muriatic acid, in combination with soda, which latter, when separated, became sulphate of soda. Before the introduction of the plaintiff's invention, the apparatus in use were first egg-shaped pots and iron cylinders, afterwards a reverberatory furnace, composed of brick, and subsequently Lutwyche's patent, which contained both an iron decomposer and brick roaster, heated by separate fires. As an improvement on all these, the plaintiff, on the 11th of March, 1839, obtained a patent for his invention; the construction of his apparatus was as follows:—At each end of an almost square body of brickwork an iron decomposing retort was placed, and in the centre a roasting or finishing furnace, between which and the two former there was a connection by means of a small door. Under each of these compartments there was a separate and distinct fire-place. The common salt, being put in at either of the end retorts, through a side aperture, was brought in contact with sulphuric acid, supplied through the same aperture, at a temperature a little above boiling water, from 200° to 300° F., by the absorption of which it became decomposed. After having been turned several times by means of a rake, the salt so decomposed was then pushed through the small connecting door into the roasting furnace, where it became subjected to an increased temperature, amounting to a red heat, or nearly so. In that state, after having been again similarly raked, the muriatic acid was given off in a gaseous form, the remaining deposit being sulphate of soda. The gas so evolved passed through certain tubes, and was conveyed into three cisterns, arranged one above another, and filled with small pebbles or pieces of glass, surrounded by water—the latter being supplied from a reservoir placed above all, and trickling through a pipe from one cistern to another. So soon as the gas came in contact with the cold surface presented by the pebbles and water, it was condensed, and, being absorbed, became liquid muriatic acid. The strength of this acid increased in its descent from the highest cistern, as the supply of gas into the second and third cisterns was condensed and absorbed by the action not of water merely, but by a weaker description of acid trickling from the cistern immediately above; so that three different strengths could at any time be obtained. This apparatus was stated to be different in principle from, and to possess many advantages over, the former; but the main distinctions consisted in its having distinct fires for the separate compartments, acting on the bottom and sides of the retorts, the smoke being carried off in a different channel from that through which the acid passed; and, further, that two decomposing retorts, separate from the roasting furnace, prevented any delay for the purpose of cooling. The process of condensing and preparing the acid was also stated to be quite a novel and important improvement. A model of the defendant's apparatus was produced in court, and the witnesses described it as being substantially the same as the plaintiff's; it, however, contained a brick and not an iron roaster. The plaintiff's specification was also put in as evidence, by which he claimed iron retorts worked in connection with each other, and constantly maintained at an elevated temperature.

On behalf of the defendant it was proved by several witnesses, practically acquainted with the manufacture in question, that the principle of having the decomposer and roaster in separate compartments, with an aperture between, and separate fires, was not new. They further stated, that the sulphate of soda, made in iron roasters, was not fit for some purposes, such as the finer kinds of glass, as it contained more or less iron, and the acid not so well disengaged; and that there was a difference in price between it and brick-furnace soda of about 2*l.* per ton. The expense, too, of brick-roasters was considerably less than that of iron.

Upon this evidence the jury had found for the plaintiff on the plea of not guilty, and specially that, assuming the models to be correct, there had been an infringement by the defendant; secondly, that the invention of two separate chambers or furnaces was not new, but that the plaintiff's mode of connecting the same was new; thirdly, that the specification was sufficient; and, fourthly, that the process patented was an improvement on the old system of producing sulphate of soda. Each party had obtained leave to enter a verdict in his favour on this special finding; and in Easter Term last, cross rules had been accordingly granted and afterwards argued.

Mr. Justice Coltman said that this was an action for an infringement of the plaintiff's patent, granted to him for an improvement in an apparatus for the decomposition of common salt in the manufacture of sulphate of soda, chlorine, and chlorides. The defendant pleaded "not guilty;" that the plaintiff was not the inventor; and that the invention was not new, as described in the specification. There were several other pleas, which it was not necessary to mention. The plaintiff proved that the apparatus formerly used for making sulphate of soda consisted of a common reverberatory furnace, composed of brick, and at a subsequent period

"Lutwyche's patent" came into operation. This latter process consisted in the use of an iron furnace for decomposing, and a brick furnace for roasting. The plaintiff stated, in his specification, that, instead of brick furnaces hiterto employed in the decomposition of common salt, and for its conversion into sulphate of soda, he had found that iron retorts, worked in connection with each other, and constantly maintained at an elevated temperature, might be advantageously used. The words of the specification were—"I do not claim the exclusive use of iron retorts, but I claim, as my invention, iron retorts (one for decomposing and the other for roasting) worked in connection with each other." For the plaintiff a good deal of evidence was adduced to show that the use of two separate chambers or furnaces, with distinct fires, was not known previous to his invention. The defendant proved that the principle of employing a decomposer and roaster in separate compartments was not new, and that the mode of producing sulphate of soda by the use of iron retorts was not an improvement in the manufacture. Upon this evidence the jury found for the plaintiff on the issue of not guilty, and there was a special finding to the effect that the invention of two separate chambers or furnaces was not new, but that the plaintiff's mode of connecting the same was new. The result of this verdiet was that each party had obtained leave to move for a verdict to be entered in his favour. Cross rules were accordingly granted in Easter Term, and in Trinity Term the case came on for argument. The court were of opinton that the verdict, on the plea of not guilty, must stand for the plaintiff. The other question depended upon what was the true nature of the plaintiff's claim as the inventor. The jury found that, if he claimed for two separate chambers, the invention in that respect was not new, but that the plaintiff's mode of connecting the same was new. It appeared to them (the learned judges) that no reasonable doubts could be entertained as to the claim made by the plaintiff. Looking at the terms of the specification, the court could not say that the claim was for separate chambers worked in connection with each other. That the plaintiff so understood the claim was clear from the terms of the disclaimer which appeared in evidence. The effect of this would be, that the verdict upon this special finding must be entered for the defendant on the second and third issues, and the plaintiff's rule must be discharged altogether. Verdict entered accordingly.

ON THE BEST MODE OF FEEDING CATTLE.

BY PROFESSOR JOHNSTON.

THE following is the substance of a lecture delivered at Inverness, before the Highland Society of Scotland. After a few preliminary observations, the lecturer observed—

That he appeared before the meeting as the representative of the Agricultural Chemistry Association of Scotland. They had all heard of that Association, and many of them were members of it. The object of the Association in having these meetings was twofold. Every one, acquainted with the state of agriculture in different parts of Great Britain, cannot have failed to observe certain practices in operation, in various parts, of which agriculturists in general might profitably avail themselves. By going into different counties, they found practical men possessed of knowledge, the diffusion of which would be of the greatest possible advantage to the general mass of the agricultural community. Now, the purpose which the Agricultural Chemistry Association had in view—in connection with these general observations—was to collect all the information in their power, through their officers or organs, or through meetings such as this; and, having collected that knowledge, their next great object is to diffuse it in such a way as to be productive of the most beneficial results to agriculture in general. Like scattering seed through their fields, the diffusion of that knowledge would produce vegetation in spring, and fruit in autumn, and the more liberal the deposit, the more abundant the return. They were here met together, consequently, in possession of a mass of knowledge in regard to the objects of the Association, so that the agriculturists present might aid them in the diffusion of that knowledge. In selecting topics for discussion at these meetings, they looked to the character of the country, and inquired of practical men in the district what topics were best suited for the purpose of affording useful information; and as the question of the use of prepared food for cattle was one of very general interest in this as well as in other parts of the country, it was to form the first subject of this morning's conversation. The second subject, on the other hand, being one rather pastoral than agricultural, had a direct bearing upon questions of great interest to the farmers in Sutherlandshire, and in other districts around Inverness, and in this respect was peculiarly appropriate. In reference to the first question—the feeding of cattle—no district in the island was more interested than this. He could not tell them how much stock was shipped from Inverness last year, but he trusted Dr. Nicol, or some other gentleman, would be able to furnish them with information on the subject. He believed, however, it was to a very large amount indeed; and he had no doubt but it was increased since by the greater facilities of communication with the

London and other markets. As a cattle importing district, therefore, the extension of sound information in regard to the economical use of food, must be of the very greatest importance; that is, in what way they could grow the greatest amount of beef or mutton at the least possible expense. This, he was prepared to show, was to be effected by the use of certain mixed food, and prepared food. An individual going from one end of the country to another to observe the state of agriculture, will look, not merely at the kind of stock, but he will more particularly observe the implements of husbandry in use throughout the various districts. In order, therefore, to form an estimate of the degree of attention paid to this matter of prepared food in England, on his visit to Newcastle, at the great cattle-show recently held there, he turned his attention particularly to the examination of the implements exhibited having a bearing upon this point. Amongst these he found chaff-cutters, a peculiar machine for crushing corn and other seeds, and other instruments; all showing how much regard was being paid to this subject by practical men. There was no doubt but that the subject of the quantity of food which cattle required to produce a certain weight of beef was beginning to attract general attention; but before he entered upon the few points which he meant to notice in connection with this question, perhaps it would be necessary to explain shortly the general composition of food. In all kinds of bread there were contained three different kinds of matter. First of all there was a certain quantity of fat, which the butter they ate represented; secondly, there was a certain amount of sugar; and then there was, besides, the third constituent, which was represented by the white of an egg. Now, it was of the very greatest importance what description of food was used, and what proportion it contained of these three kinds of matter, as bearing upon the purpose it was intended to serve. Cattle had in their bodies different forms of matter, also, but particularly flesh and fat; and the farmer should be sufficiently acquainted with the nature of food, to be able to distinguish what he should use when he wished to produce fat, or when he wished to produce fat and lean both together; and the food which was given would effect the one or the other of those purposes, according to its composition. The white of an egg, or albumen, would supply nothing, or nearly so, to the animal, but muscle. The fat went directly to form fat. The starch in food kept the body warm, and, when fat was wanted, served the purpose of making the oily matter more readily become fat in the body of the animal. Now, in fattening cattle, as in everything else, using the proper means produced the proper effects; and after the explanation which he had given, they would see at once that a mixture of food was better than the use of one kind alone. If they wanted to lay on muscle, they would feed with food containing the largest amount of gluten; and if they wanted to lay on fat, they would give starch and oily substances, and only a small proportion of the other ingredient. Selecting food in any other way would not serve the purpose they had in view in the most economical way. He had a table representing the different proportions of fat in the food which they were in the habit of using; but he would illustrate what he had to say by a few simple illustrations. Wheat contained two per cent. of fat, and sometimes a little more; but oats contained sometimes from four to five per cent., or about double the amount which was to be found in wheat. Oats were next to Indian corn in this respect, the latter of which they were aware contained a large amount of fat. Gluten was the matter out of which the muscle was produced, and there was more of that substance in the bean and the pea than in the oat; but the oat was better than wheat. But there was another kind of food used for fattening cattle, namely, oilcake, which contained a greater amount of fat than the same weight of any other kind of grain. Linseed, from which oilcake was made, differed from other descriptions of grain, in containing a greater amount of fat, and a larger amount of gluten likewise, with the exception of the bean. Now, practical men have derived great advantage from feeding their cattle on oil seeds; that food, from the peculiarity of its composition, laying on fat and muscle at the same time. Oilcake, however, was the best food only when the greatest amount of fat was required; and, according to the purpose which they had in view, farmers would give their cattle other descriptions of food. It was a remarkable circumstance, that the bean and pea contained very little fat, and as the wheels of the animal system required to be greased, these kinds of grain would not serve for that purpose, although they contained what made muscle. Although beans and peas were good food, therefore, they were not good as the sole food of animals. Besides, they would observe that, from their different constituents, plenty of oil seeds and plenty of beans and peas would be far more profitable than if they were to give either of them singly. That was the principle upon which the use of mixed food was founded—to give all the substances the animal required, and to give them at the cheapest rate; and the researches of the scientific man were directed to discovering the means by which these objects could be best accomplished. He had selected oil seeds, but he might have taken potatoes or turnips for his illustration. He had taken the oil seeds, however, because very great attention had been recently directed to the value of those seeds in the feeding of stock, and to the culture of flax, which they knew was advancing with great rapidity in the neighbouring country of Ireland, and which was even progressing in England at a great rate. He might mention a remarkable fact connected with the improvement of the flax cultivation in Ireland, that a society which was established for the encouragement of that cultivation, and which

had its seat in Belfast, had an annual revenue of between 2,000*l.* and 3,000*l.*; while the income of the Royal Agricultural Association of Ireland was less than one-half of that sum. From the progress the cultivation of flax was making in Ireland, it was very deserving of attention by those who thought a change in the rotation of crops would be useful in other parts of the country. The person who had most directed his attention, practically, to the effects of feeding stock with mixed food, and to feeding on linseed, was Mr. Warnes, of Frimlingham, Norfolk, and he (Professor J.) would point out to them the principles on which he proceeded; and they were sound scientific principles. He commenced by boiling the linseed in water until it formed a kind of jelly; then he stirred in a quantity of cut straw and chaff, and crushed corn. The mixture was then poured into moulds, and afterwards served to the cattle warm, which they liked remarkably well. With this food the cattle throve, and acquired beef in an extraordinary manner. By this system of feeding Mr. Warnes said he could compete with any man, whether foreigner or not, as he could send cattle to Smithfield at 4½d. per lb., and pay him an ample return; and in illustration of this, he gives the results of two experiments, which he would read to the meeting, and which were as follows:—

Since he followed out box-feeding, he knew not a single instance where he had not realised 8*l.* for every head of cattle he had kept for six months. At the farm where he now resided, he had reared for market the following cattle, after only six months' box-feeding:—

7 Durham steers cost 8*l.*, 10*s.* each, sold for 19*l.* 10*s.* each, ...	£	277	0 0
6 Scotch steers cost 10*l.* each, sold for 22*l.* 10*s.* each		75	0 0
1 Cow cost 5*l.* 5*s.*, sold for 15*l.*		9	15 0
4 Scotch steers cost 10*l.* each, sold for 20*l.* each		40	0 0
	£	201	15 0

The above cattle were bought in and disposed of within six months. They consumed, with the following now in herd, nineteen acres of turnips, about fourteen quarters of linseed, and a few bushels of barley-meal, with several acres of pea-straw:—

3 Durham heifers, estimated value above the cost price	£	22	10 0
2 Irish steers		13	0 0
5 Small steers and heifers		30	0 0
3 Calves, and butter from two cows ..		11	0 0
	£	76	10 0
Deduct for 14 quarters of linseed, mostly grown upon the farm, 35*l.*, also for barley, 4*l.*		39	0 0
Profit	£	37	10 0

In reference to Mr. Warnes's experiments, too, it was to be observed that the value of the manure was very much increased in comparison with that derived from the ordinary method of feeding. But, besides this, there was another method of feeding of which he would speak from personal observation, and which he had witnessed in the neighbourhood of Northallerton. He went to that place because he had heard that Mr. Marshall was keeping double the amount of stock, with the same quantity of turnips, that he had been in the habit of doing only two years ago; the other food used being ground oats, barley, rye, and old beans, and chopped hay, instead of straw at times; but the cattle did best with the straw. Hearing, as he had stated, that Mr. Marshall kept double the stock upon the same amount of turnips, by his system of feeding, he (Professor Johnston) was very anxious to see the mode of carrying his system into operation, and went down to Yorkshire for that purpose. There he saw about 200 head of cattle feeding, a portion of which was sold off every week and their places supplied by others. What struck him as very remarkable, was the state of absolute rest in which he found the cattle. There was not a single beast upon its legs; no motion was observed, which, they were aware, was a circumstance favourable for fattening. In connection with this subject he got the following information, and in order that they might fully understand it, he would present it in a tabular form. It was as follows:—

Linseed, 2 lbs., boiled for 3 hours in 4 gallons water.
Cut straw, 10 lbs. } mixed with jelly.
Growing corn, 5 lbs. }

To be given in two messes, alternately with two feeds of Swedes. Now, the mode in which the linseed was boiled was of considerable consequence. In the first place it was boiled for three hours. The jelly was then poured upon crushed grain and cut straw, much in the same manner in which a man made mortar, being mixed together with a shovel, and allowed to stand for an hour. It was then stirred again, and after the lapse of two hours it was given to the cattle in a hot state, and the result was, that if the animals are fed regularly on this kind of food, and turnips alternately, they remain in a state of extraordinary quiet. They become exceedingly fond of it, and commence bellowing whenever they hear their neighbours being served before themselves. The practice was to give them a meal of the linseed mixture at six in the morning, turnips at ten, another mess of the linseed in the afternoon, and turnips again in the evening. When he saw them first in the morning, it was after they had got their mess, and he was much astonished to see them, on visiting them on the second occasion, when they were all on the *qui vive* for their meal. Two things were to be observed in regard to this system of feeding—first, that it consisted, in addition to turnips, of a mixture of grain, straw, and linseed, in certain quantities, that it was prepared in a particular way, and given hot; and that the result was double the amount of stock kept on the same amount of land. The proportion of turnips which could be grown upon a farm usually determined the quantity of stock a man might keep; and, if, by an improvement in the system of feeding, the quantity of cattle could be doubled, by turning the money twice instead of once within a year, the farmer would obtain double the profit. But this was not the only

advantage; he would double the manure which he made at the same time, which would contribute very much to the fertility of his land; he being enabled, by the use of this linseed, to return more than he took out of it. The proportion of the food had other important consequences in regard to manuring the soil. The crushing of the grain and seeds, by reducing them to the minutest particles, made the substances of which they were composed more easily assimilated to the food of plants, and made it better manure, because of the extreme division which it had undergone. Now, they would observe that, by having this large additional amount of manure, they would get larger crops, and introduce a system which would go on annually increasing the amount of their produce, and consequently the amount of their profits. This would enable them to farm higher, and, by farming high, they would keep that place which, he was sure, they now occupied in the history of the world. He would likewise direct their attention to the use of linseed, and to the preparation of food, as being of great value in keeping working animals in good condition; but on this point he would not detain them by giving a special detail of facts, as the same general principles applied in the one case which applied in the other. As he had occupied the attention of the meeting at considerable length, he would conclude for the present, reserving any additional remarks which he had to make, and the replies to any questions which the company might think he could usefully answer, until after the general discussion was ended.

OBSERVATIONS ON THE MORE RECENT RESEARCHES IN THE MANUFACTURE OF IRON.*

BY DR. J. L. SMITH.

In a former article on this subject, the operations of the blast furnace alone were alluded to, and among the statements then given, was that of the composition of the gas taken from the mouth of the furnace; which gas contained about 24 per cent. of carbonic oxide, this representing a large portion of the combustible used, which is lost in most of the furnaces now in operation in this country.

M. Ebelman states that the combustion of the gas passing from the mouth of the blast furnace is equal to from $\frac{80}{100}$ to $\frac{87}{100}$ of the calorific effect of the coal used, and MM. Bunsen and Playfair set it down as $\frac{90}{100}$, which last I am inclined to believe is rather too large a fraction; they spoke of the furnace worked with bituminous coal, and Ebelman had made allusion to one worked with charcoal. Without being able to decide exactly what portion of the combustible of the blast furnace is lost, it is sufficient to know that it is far greater than that consumed, to lead at once to the employment of means bringing into use this waste combustible.

The employment of the heat lost from the mouth of the blast furnace, for the purposes of metallurgy, &c., has been claimed by many as having been used by them since 1834. The following are some of the claimants:—MM. Thomas and Laurès (civil engineers); MM. d'Andelarre and De Lias (forge masters at Treveray); M. le Maréchal Marmont (in Austria); M. Houseau Muiren (of Ardennes); and M. de Faber Dufour (of Wasseralfingen). All their claims of priority, however, ought to be laid aside, since the operation was performed many years prior to the time that any of them claim to have first employed the lost heat. And as a proof of this assertion, I give the following extract from the *Journal des Mines*, June, 1814.—"Aubertot of the department of Cher, and owner of furnaces and other works, in excellent condition and management, which he superintends personally, made, several years ago, a great many experiments to discover some means of economising the amount of fuel used in the working of iron, either by endeavouring to introduce the operation by the Catalan furnace, or otherwise. He was led to try what could be accomplished by making use of the flame which passed out of the blast and refining furnace. He first employed it for the cementation of steel, in which he succeeded perfectly; then he used it for calcining lime, also for burning bricks and tiles. Afterwards he passed it into a reverberatory furnace, in which the temperature was raised sufficiently to heat the blooms and bars, for hammering the one and drawing the other out. Finally he succeeded in producing all the above effects at one and the same time, by causing the flame to circulate through several furnaces side by side."

In 1834, M. Houzeau Muiren took out a patent for using the waste heat from the mouth of the blast furnace for carbonising wood at the furnace of Bievres (Ardennes); in which he states that twice the quantity of charcoal is obtained by treating the wood after his method, than by the ordinary way of burning in the woods. By the heat lost from the furnace, 100 parts of wood gave 35 of charcoal, and from 40 to 45 of charcoal *roux* (half burnt wood).

But, after all, it is not to those who first applied this lost heat to economical purposes that we are indebted for the practical information that is now in our possession; for

* *Silliman's Journal.*

had they made their arrangements so as to exhibit an undisputed advantage arising out of its adoption, it would not have been so tardy in its progress.

It is to M. de Faber Dufaur, superintendent of the iron works at Wasseralfingen, in the kingdom of Wurtemburg, that most of the credit is due for the present method of converting pig into wrought iron, by using and burning the gases that escaped from the mouth of the blast furnace. The best idea that can be given of the manner in which the operations are conducted in the above works, and the advantages accruing therefrom, is contained in the following short extract from a letter written by M. Grouvelle to M. Dumas.

"The establishment at Wasseralfingen is supplied with ore, three-fourths of which is a hydrated oxide of iron, and the other fourth is an ore in grains. The influence of the first species of ore gave to the pig so bad a quality that it was used altogether for castings. M. Dufaur, by his processes, without altering the operations of the blast furnace, now obtains from the pig a wrought iron of superior quality.

"The first gas furnace put in operation by him was a refining furnace, into which the pig metal was run as it issued from the blast furnace, where the refining was executed with the air of the hot blast. From this the most beautiful results were obtained, and it worked regularly during the year 1837. In 1838 he erected a puddling furnace; and finally in 1839 he completed his magnificent system for the fabrication of iron, by constructing a furnace for re-heating and welding."

At Wasseralfingen there are now turned out, annually, one million pounds of wrought iron in various forms, made in these new furnaces, and owing to the deficiency of moving power, all the pig cannot be worked up. This operation of refining iron by the combustion of gas, without any other fuel, has been in successful operation at the above locality for several years, and it has been followed with a great improvement in the quality of the iron, and has reduced the loss to one fourth of what it was originally.

This method of refining the pig has also been in active operation in a number of places, and whenever properly executed, is always attended with economy and success. M. d'Andelarre, in one of the departments of France, in a letter states, "Our puddling furnaces, heated altogether by the gas lost from the mouth of the blast furnace, has been attended with the most complete success, which rarely happens in the first attempts at the application of any improvement, which most generally require long experience. We lighted up our furnace on the morning of the 5th, and put in the first charge at 11 o'clock on the morning of the 6th, and shingled the same at three-quarters past 12. The accomplishment of the results so quickly passed our expectations, resulting in—

"1st. An economy of the total amount of fuel used in the refining of iron (which, in a furnace with two doors, amounted in twenty-four hours, to 6,000 pounds bituminous coal, costing twelve dollars).

"2nd. Improvement in the quality of the iron.

"3rd. The loss was very small, being 5 instead of 20 per cent., which it is by the old processes.

"4th. The operations of the furnaces are much improved."

Here we see that the experience of M. d'Andelarre accords exactly with that of M. Dufaur, and already have Russia, Prussia, Sweden, and Germany, sent commissioners to Wasseralfingen, to study the processes as they are there carried on. The government of Wirtemburg have opened their works to the inspection of all who may wish to make themselves acquainted with their character.

The advantages arising from the employment of the waste gas from the mouth of the blast furnace is no longer problematical, and as some of those interested in this matter may not be acquainted with the method by which the gas is collected and employed, a few words explanatory of it will not be out of place.

The gas, as it rises through the fire-room of the furnace, containing from 60 to 80 per cent. of the combustible effect of the fuel used, is made to pass into a chamber surrounding the upper and outer part of the fire-room. Into this chamber the gas is conducted by pipes from the fire-room, and other pipes are provided for drawing off the gas from the chamber. The gas is drawn out by means of blowing cylinders, and forced into the refining, puddling, or other furnace, through a number of small orifices, alternating, with other orifices, through which a hot or cold blast of air is thrown, that serves to keep up the combustion of the gas when once united; and by regulating the supply of air, by means of stop-cocks, the maximum of heat can be obtained. In order to arrive at the maximum of heat, just sufficient air should be admitted to burn all the carbonic oxide and hydrogen contained in the gas coming from the blast furnace. If the amount of air be too small, some of the combustible gases pass out unconsumed; if too great, the excess cools the furnace, and at the same time oxidises the metals undergoing refining. The regulation of the

supply of the blast is of the utmost importance, and is said to be easy of accomplishment.

The differences between the reverberating furnaces worked in this way and those in which coal is used is, that carbonic oxide with a little hydrogen is the fuel, and it is burnt by a full supply of air. It is hardly necessary to say more of the advantages that are to arise out of this important change in the working of iron; for there is no expense for fuel in the refining of the pig, as the gaseous combustible issuing from the mouth of the blast furnace is more than sufficient to refine all the pig made from the furnace. The quality of iron is also improved, as none of those impurities contained in the coal and other fuel can interfere in the working of the iron.

The sooner these modifications are introduced into our furnaces, the sooner shall we be able to place iron in the market at a price to compete with that coming from any other quarter of the world, and entering our ports free of duty; at the same time it will increase the value of those works whose wood-land has been diminished by a too rapid and improvident use of fuel.

I next pass on to make a few remarks about the *refining furnace* used in the working of iron. In these furnaces the air is thrown, by one or two tuyers, into a crucible filled with charcoal, into which the pig to be refined, along with scraps coming from previous operations, is placed in a certain relative position. The changes that take place by the reaction of the air upon the coal, is similar to what occurs in the lower part of the blast furnace, namely, the conversion of the oxygen into carbonic acid, which is immediately changed into carbonic oxide. The analyses of the gases taken from the centre of the furnace, prove that the transformation of the oxygen into carbonic acid corresponds to the position where the workmen constantly place the iron that is about to be forged, and this is just what we should expect, as it is the point of maximum temperature.

Ebelman states that the atmosphere which surrounds the melted iron contains hardly a trace of carbonic acid, either in the blast or puddling furnace; this being contrary to the opinion which is generally admitted, that the decarbonisation of the iron takes place by the action of the air during the melting of the pig: but it would appear that this reaction is attributable to the protoxide of iron covering the surface of the mass undergoing refining. In the second period of refining, in the puddling, properly speaking, is is easy to deduce from the analyses of the gas that there is oxidation of a considerable portion of the iron by the oxygen of the air thrown in at the tuyer.

Here again much of the fuel passes off under the form of carbonic oxide, thereby causing considerable waste. Of late years a modification has been introduced into the refining furnaces, even when the waste gases from the blast furnace are not employed; a modification by which none of the combustible is lost. A few words will suffice to explain how this is accomplished.

All the furnaces are modifications of the reverberatory furnace. The fuel is placed upon the grate and ignited by air thrown in from below the grate, by a bellows or otherwise. The air, in traversing the ignited coal, is first converted into carbonic acid, and then, if the bed of coal be thick enough, this last will be changed into carbonic oxide. As this, however, is generally not the case, a part of the carbonic acid passes beyond the upper surface of the fuel without having undergone a change, particularly if the blast from below has been strong and abundant. By this operation the chamber or bed of the furnace becomes heated, and a mixture of carbonic acid, carbonic oxide, nitrogen, and a little hydrogen is passed out at the flue. The object of the metallurgist, however, is not to permit any carbonic oxide or hydrogen to escape combustion, but to endeavour to add to the heat of the furnace the heat arising from the combustion of these two gases. This is readily accomplished by throwing in a second blast of air, through a number of small orifices just above the surface of the fuel: this blast to be regulated as required.

By this process we re-create, as it were, the maximum intensity of heat (which first shows itself at the lower part of the fuel on the grate, just where the air becomes converted into carbonic acid), and in the chamber where it is most wanted; for the amount of heat rendered latent by the reduction of the carbonic acid into carbonic oxide, is rendered sensible by the reproduction of the former.

The advantages arising from this method of burning the fuel, are important. In the first place the heat is diffused over a larger space, thereby heating more uniformly the metal than when it is placed in the midst of the fuel. Again, fuel of the most inferior quality can be made use of; and as evidence of this, in some trials made at Audincourt, it was proved that the reverberatory furnace could be heated to whiteness by burning the gas, and the pig melted and puddled, when a mixture of charcoal-dust and earthy matter was made use of as fuel.

Ebelman, whom I have so often quoted in

these articles, and who has certainly made the best series of scientific researches upon the subject, says, that instead of employing the action of air upon an excess of charcoal to produce the combustible gas, the vapour of water may to an extent be substituted, which produces, in contact with burning charcoal, carbonic oxide and hydrogen.

The heat of the combustion of equal volumes of hydrogen and carbonic oxide is about the same, and it can be easily deduced that the decomposition of the vapour of water by the charcoal, determines an absorption of latent heat, equal to that which is produced by the transformation of the same volume of carbonic acid into carbonic oxide. The vapour of water alone passed through the ignited coal produces all the effects just mentioned, but the absorption of latent caloric is so great as to cause the operation to cease in a few minutes. By projecting, however, a mixture of air and the vapour of water through the coal, the operation is said to be carried on advantageously.

It was my intention to have remarked, at length, about the effects of the hot blast, but it is now so generally admitted that the hot is to be preferred to the cold blast in reducing the iron from the ore, and bringing it to its most refined state, that anything on the subject at this time would be superfluous. All that is important to make known upon this subject is the results lately arrived at by M. Scheerer, as to how it is that hot air produces such remarkable effects in the blast furnace.

By calculations, based upon his own experiments as well as those of others, he was led to the conclusion, that the most elevated temperature that charcoal could produce in burning in air, is 2571° C., which is that at which platinum melts. This temperature is situated in the middle of the space upon which the air is projected, and it goes on diminishing towards the exterior, so as to form a space for melting, the centre of which is at 2571° C. and the exterior at 1550° C. When the hot blast is made use of, the temperature of the centre does not change, but the portion heated to 2571° C. becomes more extended. The exterior of the mass which was at 1550° C. while using the cold air, acquires when the hot blast is employed, a temperature as many degrees higher as there is difference between the temperature of the two blasts; for instance, if the temperature of the air be 280° C., that of the exterior of the heated mass will be 1830° C.—if 300° C., the latter will be 1850° C.

Thus the influence that hot air exercises, is to extend the space of fusion, which is twice as great with the air at 300° C. as it is when the air is at 0° C.

THE INFLUENCE OF MANURES ON THE HEALTH OF CATTLE.*

Mr. Silvester presented to the Veterinary Medical Association, at one of its recent meetings, some of the urine and the bladder and kidneys of a sheep. The coats of the bladder were much inflamed, and covered, as was also the urethra, with a quantity of calcareous matter. Mr. Morton said, "that he had found the specific gravity of the urine to be 1·20; it possessed an alkaline reaction, and he had obtained traces of the presence of both albumen and bile in it. The calcareous deposits consisted of animal matter and carbonate of lime." And he entered into a theoretical explanation of the source of the deposit in connexion with the food of the animals. Mr. Simmonds added his experience on the subject, saying, that "there could be no doubt of the advantages to be derived from an application of the principles of chemistry to pathology. It was only of late years that calcareous deposits in the bladders of sheep had been so frequently observed, and in those cases the sheep had been fed on vegetables growing on land which had been recently limed; hence it was easy to account for the formation of the calculi. In the specimens submitted, the deposit of carbonate of lime was to such an amount, that the entire mucous coat of the urethra was covered more or less with calcareous matter, and within the vermiform appendage the canal was blocked up; the bladder in consequence had become greatly distended, The sheep died from long retention of urine, consequent upon calcareous deposition." Mr. Cox related an instance of a large dairy of cows being fed on turnips that had been grown on land manured with guano, and all of them became affected with nephritis. The bulbs were given with the earth upon them. The disease disappeared when the food was changed, but again returned on the turnips being allowed. Mr. Morton added—"Such an effect from such a cause was highly probable, as guano contained several of the salts of ammonia, which, acting as diuretics, would be very like to produce nephritis."

* *Lancet*, and *Trans. Vet. Association.*

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

A MEMOIR ON IODIDE OF IRON.*

BY M. C. CALLOUD.

The employment of iodide of iron in the state of protoiodide, (with the extent of the therapeutic value of which M. Dupasquier, of Lyons, informed us, in a memoir published in 1841), has since then been generally adopted. Preparations insuring a certain degree of stability in the ferrous salt were destined to replace the old iodide, whose variable changes were well known. Still, however, in several prescriptions, where iodide of iron was prescribed as an alcoholic tincture, no other could be employed, and we were thus reduced to the necessity of using a preparation, even then acknowledged to be defective.

To persuade the medical man to reject the employment of so deteriorated a preparation, it became a useful task to examine it analytically, and to represent the relative quantities of the iron in combination, the iron separated, and of the iodine set at liberty, in common iodide of iron.

With this intention, several specimens of dry iodide of iron were examined, and the analysis shewed, not only that the iodide had undergone a great change, but that complete decomposition had taken place. In the latter case there was the appearance of solubility in water; but this solubility was due to the accidental presence of an iodurated salt, quite distinct from iodide of iron.

The different samples of iodide examined were in the following states:—1. Recently prepared. 2. In a state of deliquescence. 3. Spontaneously dried, after having passed the period of deliquescence.

The state of change and decomposition which analysis exhibited were—

1. The recently prepared, half decomposed. 2. In a state of deliquescence, decomposed to $\frac{3}{100}$. 3. Dried after deliquescence, entirely decomposed.

Five grammes of each sample of the dry iodide of the apothecaries were dissolved in distilled water; the solution, after being filtered, to separate the insoluble portion, was treated with hydrate of potash, which precipitated the remainder of the iron in combination. The calculation, deduced from the portion remaining undissolved in the water, and the oxide of iron precipitated by the potash, indicated their composition to be—

I. IODIDE.

Iodine and iron, combined in the state of protoiodide	2·710
Free iodine	1·740
Iron separated as a sesquioxide	0·550
	5·000

II. IODIDE.

Iodine and iron combined as iodide of iron	1·940
Free iodine	2·085
Iron separated as a sesquioxide	0·725
The hygrometric state of the iodurated salt	0·250
	5·000

These two iodides produced a clouded solution, very highly coloured, with the smell of iodine, and not comporting themselves with reagents like the persalts of iron. They are precipitated of a light blue colour by ferrocyanide of potash, and of a green colour by the alkalies.

As to the iodide, No. 3, it was entirely decomposed, and all the iron had passed into the state of oxiodide, thus forming, with the reduced iodine, a mixture absolutely insoluble in water. The portion dissolved by the water did not exhibit, on the application of the most delicate tests, any trace of iron in combination, but only manganese, which was present in a soluble combination, with iodine in the state of sesqui-iodide. This fact, which has been also noticed in certain iodides of commerce, arises from the iron employed in the preparation of the iodide containing manganese, like that obtained from carbonated minerals of iron, which are always combined with manganese.

We thus see that the iodide of iron obtained by evaporating it to dryness, forms one of the most imperfect preparations, and that its therapeutic employment is subject to sufficiently serious variations.

In the employment of iodide of iron, in evaporating the protoiodurated solution, a disengagement of hydroiodic gas takes place, from whence results the first decomposition of the salt, and we obtain, as a product, a corresponding quantity of oxiodide, mixed with the undecomposed iodide, and this decomposition of the solution into hydroiodic

* *Journal de Chimie.*

acid and oxiodide, does not cease until the watery vapours, which are abundantly produced, prevent the contact of the air with the salts in the solution. Although iodide of iron is not met with, with the iodide in excess, we cannot admit that it has passed into the state of sesqui-iodide, or that the half proportion of iodine in excess, is entirely combined, for as such it scarcely has the characteristics of the intermediate salts of iron. Already the smell and taste declare the presence of free iodine; and the solution rendered colourless by solid stareh, is precipitated of a light blue by ferrocyanide of potash, and green by the alkalies: the iodide of iron ought therefore to correspond with ferroso-ferric oxide. The rather that, by analogy with the combinations of chlorurated iron, we must grant to the periodide more stability than to protoiodide; but experiment does not justify this, for the iodide of iron of pharmacy, by being constantly subjected to the hygrometric and oxidating action of the air, becomes completely decomposed, even at the temperature of the atmosphere. This can be readily recognised in the manufactories of dry iodide of iron, when the naked eye can detect flakes of crystallised iodine, adhering to a bluish mass, friable, and insoluble in water, which is no other than a mixture of reduced iodine and sesquioxiodide of iron.

IODIDE OF IRON OBTAINED BY DOUBLE DECOMPOSITION.

By reducing iodide of potassium, and sulphate of protoxide of iron, into a fine powder, and triturating the mixture of the two salts, we obtain the protoiodide of iron.

1 Part sulphate of crystallised protoxide of iron ..... 161·52

1 Part iodide of potassium ..... 206·94

The double decomposition being produced by the assistance of the water of crystallisation of the sulphate of iron, we treat it with alcohol at 85° per cent., which only dissolves the iodide of iron that is formed. The alcoholic solution has all the characters of the protosalts of iron; and the reaction of the two salts is complete. The sulphate of potash is, in this case, in the condition of the insoluble salts.

The ferrous iodide, thus mixed with the sulphate of potash, may be employed therapeutically with undoubted advantage, for it is in a dry state, and unaltered.

The following formula may serve for certain pharmaceutical preparations, having iodide of iron for a base:—

	Parts.
Crystallised sulphate of iron ..	3
Iodide of potash	4

It is important to choose the sulphate of iron in small, colourless, and translucent crystals, which integrally represent the protoxidated salt, with seven proportions of water. The iodide of potash ought to be perfectly neutral and pure; the least excess of alkali in the iodide would, also, be at once shown by the sulphate of iron, which, in this case, is a good test. To be satisfied of the purity of the substances, the mixture of the two salts being dissolved in a certain quantity of water, the latter ought not to be rendered cloudy by the green or yellow oxide of iron, which would indicate the employment of a basic iodide of potash, or a sulphate of iron, partially peroxidated.

PILLS OF PROTOIODIDE OF IRON.

	Gram.	Cent.
Crystallised sulphate of iron	1	60
Iodide of potassium	2	10
Gum tragacanth	0	30
Sugar	1	00

Syrup of marsh mallow powder q.s. for 36 pills.

Each pill contains 52 millig. of dry iodide of iron, or 71 millig. of the hydrated iodide, and 26 millig. of sulphate of potash.

We obtain a mass that can be easily preserved, by substituting 2 grammes of the crumb of bread for the gum and syrup. These pills are to be rolled in lycopodium powder, and placed in a dry place.

The following preparations may replace the usual formulæ:—

TINCTURE OF PROTOIDIDE OF IRON.

	Gram.	Cent.
Crystallised sulphate of iron	0	80
Iodide of potassium	1	10
Alcohol at 85° per cent. ..	16	00

We triturate the two salts, as directed above, dissolve the ferrous iodide in the alcohol, and filter.

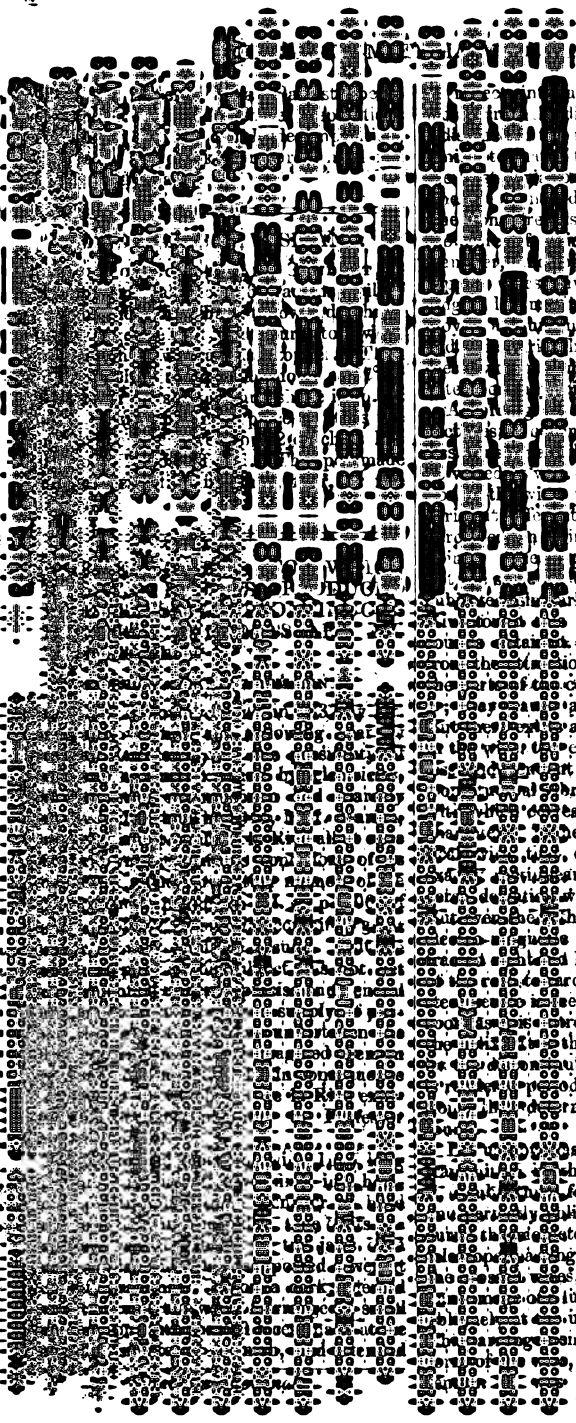
It is then to be placed in a well stoppered bottle, completely filled with the alcoholic tincture. A small excess of iodide of potassium gives it more stability. 16 grammes of the tincture contain 1 gram. of iodide of iron.

IODIDE OF IRON WINE.

	Gram.	Cent.
Sulphate of iron	0	80
Iodide of potassium ..	1	10
White wine	32	00

The two salts being pulverised, we add a few drops of wine to the mixture, quickly triturate it, then dissolve it in the rest of the wine, and filter.

32 Grammes of the wine contain 1 gramme of ferrous iodide, besides a little sulphate of



telescope furnished with
divisions of a scale placed at
metres. This arrangement,
the magnetometer, exhibits
ns of the reflecting surface,
displaced parallel to itself.
ssed through a wooden reel
ch was five centimetres in
which were rolled three
veloped with silk; 23m.6
etres in diameter. I em-
's battery of eleven pairs,
heotome or contact breaker;
ents were enclosed in an
ing the laboratory.

the place which the wire
mes the seat of greater or
brations, whose plane may
In general, in any posi-
the intensity of the effect
t points of its length, as is
inging the mirror to such
plitude of the vibrations is
different parts of the wire
rly to the reel. M. de la
by the comparison of the
These phenomena result
ion exerted upon the wire by
the coil which are the nearest to
a distinct class of sounds.
another cause of vibrations
effect of which is more or
of this lateral attraction.
brations are produced in it,
espond sounds of a peculiar
e axis of the reel was iden-
of the wire, supposing it
r and cylindrical, a trans-
ould no longer take place.
the molecules on which the
action is exerted are at-
left of the centre of the axis
ards this central point, as a
en to be drawn into it as
roduced into the hollow of
this internal vibration which,
uity of the electric current,
odical in two opposite direc-
rmines the second class of
as to the case of the current
the wire. In order to study
for the mirror the spherical
lished bulb of a small mer-
ater. The optical axis of the
through the intersection of
was directed on the dril-
luminous point reflected very
upper part of the convexity.
ment discovers any change in
even in the direction of its
not able to perceive any

elongation of the wire under the electric action, although it gave a very distinct sound. I attribute the principal cause of this sound to the polary arrangement which the molecules undergo in order to give passage to the electricity. This arrangement is manifest in many cases, and I have elsewhere pointed out a very great number of them. It is the result of a struggle between the molecular forces which constituted the primitive state of equilibrium of the body and the new activity which the dynamical condition of the fluid excites. If the flow of the latter is continuous, this struggle is instantaneous, and the noise which it occasions is null or nearly so; but it recommences with each closing of the circuit if the flow is periodical.

It is already known from the experiments of M. Peltier, and of various scientific men, that the prolonged passage of the electricity by metallic wires alters essentially their tenacity. It seemed to me very probable that the elasticity of wires subjected for some time to the intermittence of currents which renders them sonorous, must be altered in a permanent manner.

Since the experiments just mentioned were made, M. Wertheim has published a very interesting note, in which he describes a process of observation analogous to mine, although less delicate, and indicates the causes to which he attributes the sounds produced. Although I agree with him on most points, I differ from him both as to what relates to the attraction exerted from the two sides of the centre of the helix, an attraction which he does not mention, and in the explanation of the case in which the wire is directly traversed by the discontinuous current. The skilful experimentalist whom I have just named attributes the sound produced to the heat engendered by the current. Nevertheless, my wire indicated no perceptible heat. It results from the experiments of M. de la Rive and my own, that the sonorous state continues with more than 600 interruptions a second. How shall we admit that the elevation of temperature, and the diminution of elasticity which accompany it, can disappear in $\frac{1}{600}$th of a second? The current of a pile of eleven pairs certainly does not alter the thermical state of a bar of a centimetre square in section, as I have directly established: nevertheless, if it be discontinuous, it renders it sonorous. I may add, finally, that this heating does not take place when the reel is employed, as any one may convince himself by placing a bismuth and iron pair in its hollow, connected with a very delicate rheometer. Nevertheless, the sonorous property may be the same as with the wire directly subjected to the current.

PROSECUTIONS BY THE SOCIETY OF APOTHECARIES.*

The Society of Apothecaries have begun to act upon the notice issued by them, some months ago, against persons practising illegally as apothecaries in England and Wales. We have already given an account of an action brought against a person named Walls, who was engaged in practice at Bristol, without a licence. In that case, a verdict against the party prosecuted was obtained with the utmost ease. Thus, the Apothecaries' Society, which, for a long series of years, used their power of restraint in a lax and objectionable manner, and which during the discussion of Sir James Graham's plans of medical reform, publicly proclaimed that the law gave them no real power to protect their licentiates or the public against ignorant or unqualified persons, have made their re-appearance in the character of a medical police; first, in formal advertisement, and next, and successfully, in a court of justice. We have said that the verdict was easily obtained; even the defendant's counsel had not a word to say against the prosecution, but allowed that it was an imperative duty of the Society. This speaks well for the care taken in bringing the case for trial, and we are most happy that the result should have given such a flat contradiction to the Society's own previous reading of their powers under the Apothecaries' Act.

NEW MEANS OF DISINFECTING DISSECTING ROOMS.†

M. Sucquet has presented the Academy of Sciences with an account of his new mode of impeding the putrefaction of subjects used for dissection. He observes, the means which at present imperfectly accomplish that object, as arsenic, corrosive sublimate, &c., either injure the edges of cutting instruments, or prove detrimental to the health of those who use them. He employs two substances—namely, a solution of sulphite of soda, and one of chloride (chlorure) of zinc. The first of these is injected into any large artery, returns by the veins, and even fills the lymphatics. It exerts no chemical effect upon the blood, but effectually cleanses out the minutest capillaries, so that other injections may be used afterwards. The volume, consistence, colour, &c., of parts are all preserved, and remain so, if the integument be undisturbed, so that air does not obtain

* *Lancet.*

† *Medico-Chirurgical Review.*

access for a month as an average period, but sometimes even for forty or fifty days, and that in a moist atmosphere, at a temperature of 54°. The sulphite absorbs the oxygen given off by the tissues, and prevents it taking part in the putrefactive process.

This substance, however, does not protect from putrefaction for more than twenty days, when the integument is destroyed, and the tissues are exposed to the air; but the parts may be preserved for ever free from putrefaction by the use of the chloride of zinc. Parts required for further dissection should be immersed in it, and all those in which putrefaction is about to commence should be daily sponged with it. Its action is instantaneous. Parts which have become green and softened are at once disinfected, all the tissues it comes in contact with becoming white and hard. It acts by precipitating the soluble portion of the animal fluids, as albumen, fibrin, &c., and it coagulates cerebral and fibrous tissue.

CASE, SHOWING WITH WHAT CAUTION SPECULATIVE CHEMICAL TESTIMONY OUGHT TO BE RECEIVED.

The following letter, addressed, "To the Editor of the *Lancet*," is well deserving of notice.

"Sir,—Knowing the readiness with which you always give publicity to facts, the propagation of which may be of essential service, and especially those connected with the medical profession, I take the liberty of enclosing to you for publication, under the above heading, the following particulars, which came under my observation at the trial of Mary North, at the Surrey Assizes, at Guildford, on the first instant, on a charge of murdering an infant, named Mary Ann Barker, on which occasion I acted as attorney for the prisoner. The chemist alluded to was Mr. Alfred Swaine Taylor, lecturer on medical jurisprudence at Guy's Hospital, and the surgeon was Mr. Tatham, of Wandsworth. From experiments which I had previously made, in order to convince my own mind, I became aware of the difference in colour which would arise upon mixing the ingredients in a different order; and I instructed Mr. Locke, my counsel, to insist upon the experiment being repeated in court in the manner it was. The girl was acquitted, I do not hesitate to say, in consequence of it.

"I have the honour to be, Sir,

"Your obedient servant,

"John J. Harrington."

"North-street, Westminster, Aug., 1846."

At the recent trial of a young woman, on a charge of the murder of an infant, by administering vitriol to it, the prisoner's defence rested entirely upon this question—whether sulphuric acid, sugar, and water, mixed together in certain proportions, and aniseed, sugar and water, mixed together in like proportions, would, in point of colour, a few minutes afterwards, produce a similar, or a somewhat similar appearance. The girl's life, undoubtedly, hung upon the result. It was the only link wanting to establish her complete defence. If the same result as to appearances followed upon the mixing both sets of ingredients, it established the girl's innocence. If a palpably different colour and appearance were the result, that must go very far towards establishing the presumption of her guilt.

The question was put to an eminent surgeon, and his answer was, that they would produce similar, or nearly similar, appearances. After he had given his evidence, and whilst the trial was proceeding, a doubt arising in his mind, he left the court with one of the most distinguished chemists of the present day, also a witness at the trial; and they together made the experiment. They returned into court, and the surgeon, in a state of excitement, requested the judge to allow him to correct his testimony, for he found, upon trial, that the two mixtures produced very different appearances; and he held up, in court, two wine-glasses, one with the aniseed mixture, which was of a yellow colour—the other with the sulphuric acid mixture, which was intensely black.

He was then asked, by the counsel for the prisoner, in what order he mixed the ingredients producing the black appearance; and he replied, the sulphuric acid first, then the sugar, and then the water; and he was then requested to repeat the experiment in court, putting first the sulphuric acid, and then the water, and then the sugar. What was the consequence? Why, instead of turning black, it remained of a yellow colour, and, as nearly as possible, resembled the mixture of the aniseed, &c.

Had the experiment not been repeated in court, in the order of mixing the ingredients in which it was there repeated, the girl, in all probability, would have been hanged!

The quantity experimented with was about a teaspoonful of sulphuric acid to two of water, and a small piece of sugar.

Mr. Harrington, observes the Editor, is entitled to great credit for the tact and ability which he displayed in this case. The life of the innocent accused person was saved by the sagacity of the attorney, and not by the eloquence of the counsel.

A SIMPLE INTRODUCTION TO THE CLINICAL CHEMISTRY OF THE URINE.*

"The urine should, for all purposes of examination, be collected clear from admixture of dust or other impurities. The morning's urine is generally employed, as it is difficult to obtain that passed during the whole twenty-four hours; but the quantity passed during this space of time should be noted; and, also, it should be ascertained whether this is greater or less than the quantity usually passed by the patient during that space of time. The note should also state what urine was examined, whether the morning's, or that passed in the course of the day.

"The characters of the fluid should then be observed—best in the glass in which the specific gravity is presently to be taken; its reaction on test-paper, and any sediment that it may have deposited. The latter should be examined under the microscope. The acid and alkaline reaction is shown by blue and red litmus-paper.

"If the urine is acid, turbid, with a red deposit staining the sides of the vessel, we know at once that the urates are in excess; if alkaline, or even acid, of a pale colour, slightly turbid, with a light cloud floating in it, and an irridescent pellicle on the top, we presume the phosphates to be in excess, and this the more if the urine is highly offensive to the smell, and full of mucous strings. A clear pale urine may be found in connection with hysteria, with Bright's disease of the kidney, or with diabetes. A smoky colour is very indicative of Bright's disease [a yellowish tint on the sides of the vessel, or communicated to linen, indicates the presence of bile]; and a greenish tint should remind us to look for crystals of oxalate of lime.

"The specific gravity is best estimated by means of a common hydrometer, made for the purpose, contained in a strong glass tube, in which it may be floated when required. It should be allowed to sink gently down to its level, as all the fluid that collects upon it higher up tends to weigh it down, and makes the urine seem of lighter specific gravity than it really is. High specific gravity, that is to say, all above 1025, may denote diabetes, or may result from the patient, at the time, employing diuretic salts. Low specific gravity, or below 1014, may be connected with granular degeneration of the kidney. The specific gravity, in connection with what has been already noted concerning the colour and reaction of the fluid, is to guide us in the subsequent application of our tests.

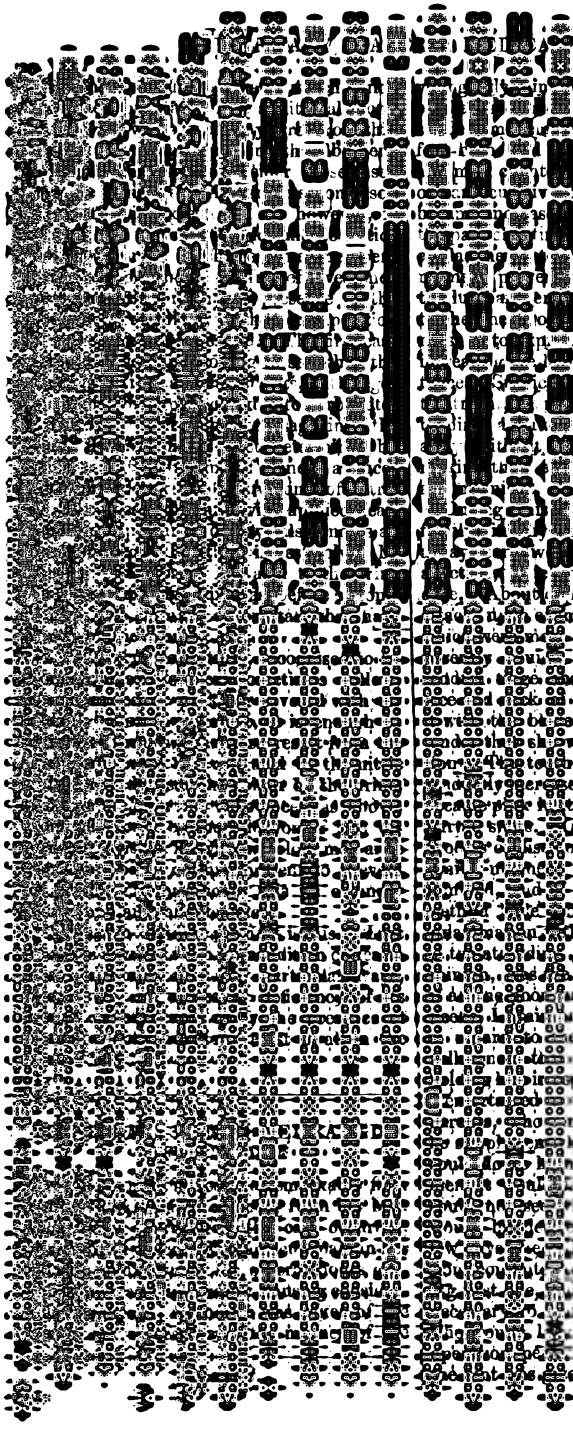
"Heat and nitric acid are, for most purposes, enough; their effects are best witnessed in common test tubes, into which the urine may readily be poured, even from a large vessel, by using one tube as the guide, down the side of which the fluid may run into the other.

"Urine of a low specific gravity had better be heated; and if a precipitate forms, a few drops of nitric acid should be added. If the precipitate re-dissolves, it is to be considered indicative of the presence of the phosphates in excess; if it do not dissolve, but be rather increased by the addition of the acid, it is albumen. It is to be remembered that a precipitation of the phosphates by heat may take place as well in acid as in alkaline urine.

"To urine of a higher specific gravity nitric acid may be added at once. Every precipitate that forms may be uric acid or albumen. To determine this, the fluid should be heated, when the precipitated uric acid will be re-dissolved, the albumen will remain coagulated. A partial or entire solution of the precipitate, by long-continued heat, may denote so interesting a form of disease, that the beginner would do well to call in the aid of a more experienced chemist under such circumstances. The results thus obtained should not be lost; the tubes must be set by for a day, and then it should be noted, by the aid of a common pocket measure, how high the precipitate stands, in the fluid, occupying, for example, half, a third, or an eighth part, as the case may be. The quantity of little crystals of uric acid that have dusted over the inside of the tube should also, at the same time, be looked to.

"If precipitate forms, a reference to the specific gravity must tell us whether there is anything more to be expected, or whether we may presume that we are dealing with healthy urine. If the specific gravity be high, and the re-agents have produced only slight effects, the nature of the case may tell us whether it be worth while to look for sugar in the urine. This is most satisfactorily effected by means of fermentation; about two drachms of the urine being introduced, with a little yeast, into a phial with a perforated cork, through which the longer leg of a bent tube passes, and the whole inverted in a cup of water, where another phial, filled with water and inverted, is to receive the short leg of the tube. At a temperature above 60°, any sugar that may be present will begin to be decomposed, and carbonic acid will collect and remain for some time unabsorbed in the other phial. If no gas collects, there is no sugar in the urine; but there may have been albumen which we have failed to detect from not adding enough acid, for a little nitric acid only renders the albumen uncoagulable;

* *Medical Gazette.*



g that it was simply a cold,
rained the joint by some
Occasionally a warm
stimulating embrocation,
rritants, were used, with-
fect. The paroxysms now
n frequency and severity,
rom the elbow-joint to the
e pectoral muscle, for the
g respiration, then, from
rse to the hip-joint down
sionally a stinging numb-
it, in the toes, of course
ness so as to require assis-
dvice was procured, and in
of scene, the springs, sea-
ge, &c., three years passed
relief, the paroxysms
arance daily, about noon

riod I had attended the
rofessional capacity, and
the case to be a neuralgic
bance or time alone would
teen months after the first
oining her mouth and teeth,
beautifully shaped, and ap-
I thought I perceived a
out the upper part of the
the front incisor; tapping
e of a pen-knife, it was so
would not permit a repeti-
was watched, and its colour
ed in intensity until it almost
s hue, with one or two small
to the next front incisor the
peration now commenced in a
the gums above becoming
a deep purple colour; the
osened, evidently from the
the periosteum. I suggested
physician that this, in my
primary and exciting cause
rl's sufferings. After a few
ressed upon him my opinion
e case. He expressed his
I should do as I pleased,
sponsible. What little doubts
the matter, I stated to the
nsulting with the physician,
ked, that extracting the teeth
n further than the disfigure-
use, at the same time, he
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o my proposition of extract-
then as many as I conceived
ng it to a successful issue.
was anxious to have the
med from the moment that
en, that in the teeth was the

source of all her suffering. I extracted the worst-looking one first, or the one most highly tinged. The patient fainted, but was speedily roused from her swoon by a most violent paroxysm. "Doctor, you were right, it is the teeth!" exclaimed the young lady, "take out the others." A brief examination of the next incisor decided me at once to take her at her word, and the other tooth was immediately extracted: she had no renewed attack or unpleasant symptom from this second operation, but reclining back upon her pillow, she subsided into a sound sleep, which continued for nine hours, and to the astonishment of her family, when they were at the breakfast table, she walked upright, without assistance, into the room; and she is now in the full enjoyment of her health.

EFFECTS OF CAMPHOR ON THE TEETH.*

BY THEODORE S. TEARNE.

During a minute attention paid to affections of the teeth for several years, I have met with very many cases of unnatural brittleness, (fragilitas dentium); and on inquiring of the individuals subject to it what dendentrifices they used, they have invariably answered, "camphorated chalk." The quantity of camphor is very small in the powders generally vended; but I have been induced to make a few experiments to ascertain the nature of the action of camphor on the teeth. I have allowed teeth to remain in chalk, impregnated with this substance, for a few days, when I have found the enamel to be appreciably altered. I have put teeth into camphorated spirit, and have perceived a similar result; the enamel becomes more brittle and more readily moved by an instrument—in fact, it appears to be rendered somewhat lighter and porous; and finally, if teeth are exposed to the fumes of camphor, morbid condition is found to supervene to a still greater extent. I have consulted many eminent professors of the dental art on this subject, but none (one excepted) had noticed this fact. I have asked one of the most emitient professors of chemistry of the day to aid me in detecting, through analysis, the action of camphor (a substance almost *sui generis*) upon the enamel, and he has kindly accorded his assistance during my researches. He recommends me to examine, through the acid of the microscope, sections of the teeth after their exposure to camphor, and I hope, after further investigation, to be able to state the real alteration which the enamel undergoes when subjected to the influence of this substance. No time, however, should be lost in cautioning society against the use of camphor as a dentifrice, as I, and others who have witnessed my experiments, are satisfied that this fragility (when arising from external causes) originates from its application. I have been strongly persuaded to offer these remarks to the public, as seven-tenths of the dentifrices now used contain more or less of this destroying agent.

* *Lancet.*

ELECTRO-PHYSIOLOGICAL RESEARCHES.*

BY M. MATTEUCCI.†

I had the honour of communicating to the Royal Academy of Sciences about a year ago, through the medium of yourself and M. Humboldt, the extract of three preceding series of my electro-physiological researches, which had just appeared in the second part of "The Philosophical Transactions of London," for the year 1845. In the former series I took up the consideration of the muscular electric current and the laws of its development, and I hope to have succeeded in proving that the origin of this current is solely due to the chemical actions which operate between muscular fibre and arterial blood. Indeed, this current, which is independent of the integrity of the nervous system, is modified as to its intensity by the respiratory and circulatory functions, by the surrounding temperature, by the presence of certain poisons or gases, which more or less destroy the arteria-realisation of the blood; and to this purpose I must refer to the argument which subsists between one of my experiments and those which you have just made respecting the influence of certain salts upon the blood. The solution of sea salt into which the muscular elements were plunged perceptibly weakens the current. It would be important during the result of your experiments to extend these researches to other salts, as I entertain no doubt of the correspondence which would be found to subsist between the two phenomena.

In the second series of my researches I have studied the natural current of the frog. I have satisfied myself beyond doubt that such a current exists in all animals; that it is due to a particular structure of muscular fasciculi, which I have succeeded in demonstrating, and that in all probability it is nothing but a muscular current.

In the third series, I have studied the

* *Comptes Rendus.*

† The substance of a letter to M. Dumas.

phenomena of induced contraction; and after having discussed with all due prolixity the different explanations which might be offered in explanation of this phenomenon, by having recourse to the theory of electric actions—after having demonstrated the resistance of this induced contraction across layers of insulating bodies, I have at length arrived at the conclusion that a process of induction is exercised, by the force displayed, in muscular contraction, and a living nerve.

Allow me now to beg that you will communicate to the Academy the fourth and fifth series of my electro-physiological researches just made, and which will be the sequel to the two former ones in "The Philosophical Transactions."

In the first part of the fifth series I have described certain new experiments on the phenomena of the torpedo. In investigating subjects so difficult and obscure, numerous experiments are required to lead to positive results. One of these results, which I have clearly demonstrated, is, that the organ of electrical fishes is composed of a great number of elementary organs, each of which is endowed with the power of developing electricity under nervous influences, so that the organ, although it possess no physical resemblance to any of our instruments, is, nevertheless, an electrical multiplier. Direct experiments have proved, that even the smallest prismatic portion of the electrical organ of the torpedo—in other words, a grain merely of that albuminous substance—yields electric discharges, so often as the nervous filament communicating with it is stimulated.

The exposition of the laws regulating the electric discharge of the torpedo may be thus simply expressed:—(1.) That the poles are at the extremities of the prisms. (2.) That the intensity of the current in different portions of the organs is proportional to the height of the prisms. (3.) That the current, when discharged, follows always the same direction. The first of these laws is demonstrated by the direction of the current, both in the gymnotus and in the torpedo; in which fishes the poles are always at the extremities of the prisms. I hope soon to be able to verify this law with regard to the silurians, after the promise which his Highness Ibrahim Pacha has condescended to make me. As it regards the second law, I have demonstrated, since the period of my first experiments, that the strongest current is obtained by applying the two extremities of the galvanometer upon those points of the dorsal and abdominal faces of the torpedo which are nearest the median line, and precisely in that situation where the organ is thickest. These results I have subsequently confirmed; nay, I have even rendered them more convincing by acting on different parts of the detached organ, and excited by irritating the nerves. As to the persistence of the electric current from the torpedo, or other electric fishes, it seems this must be referred to the specific action which I have demonstrated to appertain to the nerves of the electric organ. Whatever hypothesis may be adopted to account for the production of electricity, by nervous agency, in electrical fishes, it is in accordance with all physical analogies to assume that, being constant in the specific nerves, the direction in which the nervous force acts ought to be constant. There always remains as an undetermined element of the intensity of the discharge, the degree of excitation of the nervous system which is the cause of it. We know perfectly well that the force of this discharge varies according to the will of the animal; and, what is of more importance, that a ratio subsists between it and the animals, respiratory and alimentary functions; also with its more or less perfect condition of repose. In illustration of this fact, I will mention a circumstance which I discovered whilst experimentalizing upon the living gymnotus at this time in the Royal Palace of Naples. I found that the animal could discharge one or every portion of its organ at pleasure. Such are the principal laws of a simple fact; yet that is just as obscure as that of electrical development by chemical action, by heating the tourmaline, &c. In the cellule of the electric organ in certain fishes, composed chiefly of albumen, there is a development of electricity by nervous agency, attributable to the nervous expansions which ramify upon the cellule.

All this is very far (and I repeat it for the hundredth time) from the conclusion to which, according to Berzelius, I had arrived; that is to say, that the nervous and the electrical currents were identical.

In the second part of this fifth series of my researches I have studied anew this phenomenon of induced contraction. I will limit myself at this period of offering you the principal facts. (1) Induced contraction, or, to speak more generally, the inductive action of the nervous force, is never exercised but by a muscle in the state of contraction. I have demonstrated, by a great number of experiments, that the nerve in which the nervous action is propagated, and the nervous centre to which it proceeds, never manifest this induction—a remark which applies to every other organ except the muscles, whose nerves have been excited.

This induction is a phenomenon of muscular substance in a state of contraction (2) when an electric current has been made to pass for a long time through the muscle of an animal yet living, or only recently killed, so that a portion of the nerves supplying this muscle may be permeated from their periphery to their centre, and a portion in the contrary direction. There is constantly obtained, when the current ceases, a tetanic convulsion which remains a certain time in the muscle, of which the nerves are submitted to the inverse current; whilst nothing like this phenomenon takes place in muscles which are submitted to the direct current. Moreover, those nerves which have been submitted to the inverse current have acquired an increase of excitability, so that, by aid of very feeble stimulants, very strong contractions are produced.

MISCELLANEA.

THE CHOLERA AT KURRACHEE.*

As various accounts of the ravages the cholera has made far and wide will be sent home, perhaps a short description from one cast in the midst of the scene may not be deemed uncalled for by you or your home readers. Sunday, the 14th instant, the enemy first assailed us. There was divine service on the eve of that day at the church for as many of the Fusiliers as could be accommodated. I was there. The day had been strangely hot; during prayers, a hurricane arose, bringing columns of dust, which swept through and hung about the church. As the Fusiliers marched back from church, the wind fell as suddenly as it had arisen, the clouds of dust remained; the very heavens seemed drawn down upon our shoulders; the feeling was suffocating—all were under its influence. The 86th regiment were at roll-call; many were carried thence to the hospital, and were never more seen alive outside. The cholera had been hanging about in the bazaar, but up to this day I am not aware that any European had been attacked. The 86th and Fusiliers were in tents pitched within a quarter of a mile of each other; disease and death that night began their busy work. Her Majesty's 86th suffered first, and throughout have suffered most. That night Sir Charles Napier issued an order for them to strike their camp and move three miles nearer the sea. With daybreak they were away, leaving many dying and dead behind. By the wayside many were attacked, never to rally. For five days sorely did the destroying angel press on this regiment; 235, or thereabouts, fell victims to this scourge. The Fusiliers and Rifles suffered to a less extent; each regiment has buried about eighty-five Europeans. Who shall depict the scene in the hospitals? I speak more of the Fusiliers, because of that I saw much; every cot was filled—delirium here, death there: the fearful shrieks of pain and anguish. Men whom you had seen but a short time before hale and strong, were rolling in at every door, crowding every space—countenances so full of misery, eyes sunken and glaring, shrivelled and blackened cheeks! This, too, the work of five short minutes, or less! So sudden was death with some that they were seized, cramped, collapsed, dead, almost as fast as I have written the words. Previous health and strength were no guarantees; men attending the burials of their comrades were attacked, borne to the hospital, and themselves buried the next morning. Pits were dug in the churchyard morning and evening; sewn up in their beddings, coffinless, they were laid side by side, one service read over all. Public works were suspended during the 15th and 16th. Medicine seemed powerless; nothing that medical science could suggest took effect—they were, in fact, dealing with corpses. It was not until the third day that medicine assumed any sway; since it has done so, I should say two-thirds of the cases have been saved. Two officers have been swept off; Captain Seton, Fusiliers, was one of the first seized. He was a man of great strength, and powerful frame; he struggled for three days. Lieutenant Dawson, of the 12th regiment, N.I., died this day. His end, poor boy, was sudden. He was seized yesterday, and will be buried to-night. Nobly have the soldiers behaved to their suffering comrades; great devotion have they displayed in watching over and attending them. Sir C. Napier's conduct during this fearful trial is beyond all praise. Noble old man! no fatigue did you spare that aged, time-worn frame; wherever aid was required, there were you to see it rendered. Many were the grateful blessings breathed for you

* *Bombay Times.*

by the sick and suffering, for your exertions for their comfort. It was a goodly sight to see the grim old warrior passing up and down quietly from bedside to bedside, whispering gentle words of hope and comfort. He seemed to take no rest. Whatever difference of opinion there may be respecting Sir Charles upon other points, humanity rejoices at such conduct as this. The same good spirit actuated the authorities. Requisitions of all kinds were complied with on the instant. What death has done amongst the natives I cannot precisely say; several thousands are reported to have died in and about Kurrachee. The 12th regiment Native Infantry have suffered much; the 3rd but little. The loss of Europeans must be upwards of 450. This throws the bloody work of Meanee and Hyderabad into a nutshell. I trust I may now say the scourge has ceased. The hospitals are again tolerably clear; those who remain are recovering We have had much thunder, accompanied by heavy and frequent falls of rain, since which time the atmosphere has been clear."

SCHOENBEIN'S EXPLOSIVE COTTON.

The lecture delivered by Mr. Grove, on this substance, at the British Association, commenced by an explanation of the *rationale* of the composition of gunpowder which depends on mixing combustible substances with a substance that supplies abundance of oxygen, for the support of combustion, without depending for the supply on the oxygen of the atmosphere. Nitrate of soda, or saltpetre, was a substance that answered these conditions, and when intimately mixed with charcoal and sulphur in proper proportions, it supplied those combustible bodies at once with sufficient oxygen, and the composition became explosive at a given temperature. There was, however, a considerable residue after the explosion of even the best gunpowder, which showed that the combustion was not perfect, and the residue proved greatly inconvenient by soiling the fire-arms. In the invention of Professor Schoenbein this inconvenience was entirely remedied, and the explosive force was said to be double that of gunpowder. The substance was, in fact, cotton, which was prepared in some manner not yet made known, and could not be distinguished in its appearance from ordinary cotton. There were two qualities of the preparation, one of which was intended for common purposes, and evolved a small quantity of smoke on explosion; the other, which was more expensive in its preparation, emitted no perceptible smoke, and left no residue whatever. The gun cotton, he said, explodes at the temperature of 400 degrees—the explosive point of gunpowder being about 600 degrees; and it might be exploded on gunpowder without igniting the latter. Mr. Grove then exhibited the experiments. He first exploded a small quantity of gunpowder, for the purpose of showing the large quantity of smoke evolved. He then exploded a small lock of the gun cotton of the second quality. It flashed off as rapidly as gunpowder, and but a very small quantity of smoke was perceptible. The paper on which it was exploded was but slightly stained. The better kind of the gun cotton exploded still more rapidly, without any smoke whatever; and it gave out an orange-coloured flame. The exhibition of the experiment was received with loud applause. Mr. Grove next exhibited that peculiar property of the cotton not being injured by water. He steeped a piece of the cotton in a glass of water, and then pressing it between blotting-paper to dry. Though it could not have been thoroughly dry in the time, the cotton flashed off when the heated wire was applied to it, and without any perceptible smoke. The flash, however, was not in this case so instantaneous as that of the perfectly dry cotton. The last and most curious experiment was the explosion of a piece of the gun cotton when placed upon loose powder, without igniting the latter. The experiment succeeded perfectly, though it requires the cotton to be quite dry to insure its success, for if the combustion be less rapid the gunpowder explodes.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

During the last month the Association held its meetings at Southampton. The section of Chemical Science was presided over by Michael Faraday, L.L.D., F.R.S. Dr. Miller and Messrs. Hunt and Randall being the secretaries. Several valuable papers on chemical science were read; among others, the following:—"On the Chemical Action of Water, in the neighbourhood of Southampton, on lead, in dissolving the metal and holding the same in solution to the detriment of health," by Mr. G. H. Osborne; "A Report on the Actinograph," and Notices on the Influence of Light on the Growth of Plants, by Mr. R. Hunt; on the Nature of Lampic Acid, by Professor Connell; on the Connection between the Isomorphous Relations of the Elements and their Physiological Action, by James Blake, M.B., F.R.C.S.; on the

Chemical Action of Oxalic Acid on the Blood and Tissues of the Animal Body, by Dr. Letheby; New Facts bearing on the Chemical Theory of Volcanos, by Dr. Daubeny, &c., &c.

In the section of Geology, a paper was read, being an abridged account of a "New Method of Boring Artesian Wells," by M. Fauvelle. The paper states:—

"In 1833, I was present at the boring of an artesian well at Rivesaltes; the water was found, and spouted up abundantly. They proceeded to the tubing, and for that purpose enlarged the borehole from the top downwards. I was struck by observing that it was no longer necessary to draw the boring tools to get rid of the material, and that the water, arising from the bottom, brought up with it, in a state of solution, all the soil which the enlarging tools detached from the sides.

"I immediately observed to my friend, M. Bassal, who was with me—'This is a remarkable fact, and one very easy to imitate; if, through a hollow boring rod, water be sent down into the bore-hole as it is sunk, the water, in coming up again, must bring with it all the drilled particles.' On this principle I started to establish a new method of boring. The apparatus is composed of a hollow boring rod, formed of wrought iron tubes screwed end to end; the lower end of the hollow rod is armed with a perforating tool, suited to the character of the strata which have to be encountered. The diameter of the tool is larger than the diameter of the tubular rod, in order to form around it an annular space, through which the water and the excavated material may rise up. The upper end of the hollow rod is connected with a force-pump, by jointed or flexible tubes, which will follow the descending movement of the boring tube for an extent of some yards. This boring tube may be either worked by a rotatory movement with a turning handle, or by percussion with a jumper. The frame and tackle for lifting, lowering, and sustaining the boring tube, offer nothing particular. When the boring tube is to be worked the pump must be first put in motion.

"Through the interior of the tube a column of water is sent down to the bottom of the bore holes, which water, rising in the annular space between the exterior of the hollow boring rod, and the sides of the bore-hole, creates an ascending current which carries up the triturated soil; the boring tube is then worked like an ordinary boring rod, and as the material is acted upon by the tool at the lower end; it is immediately carried up to the top of the borehole by the ascending current of water. It is a consequence of this operation that the cuttings being constantly carried up by the water, there is no longer any occasion to draw up the boring tube to clear them away, making a very great saving of time. Another important and certainly no less advantage is, that the boring tools never get clogged by the soil; they work constantly (without meeting obstructions) through the strata to be penetrated; thus getting rid at once of nine-tenths of the difficulties of boring. In addition, it should be mentioned, that experience has shown there are no slips, in any ground which ordinary boring-rods can penetrate; that the boring tube works at 100 yards in depth with as much facility as when only ten yards down, and that from the very circumstance of its being a hollow rod, it presents more resistance to torsion than a solid rod of equal thickness and quite as much resistance to traction: these are the principal advantages of the new system of boring. Indeed these advantages have been fully confirmed by the borings which I have just completed at Perpignan, in St. Dominico's-square. This boring was commenced on the 1st July and was completed on the 23rd, by finding the artesian water at a depth of 170 metres (560 English feet). If from these twenty-three days, each of ten hours' work, are deducted three Sundays and six last days, there remain fourteen days or 140 hours of actual work; which is upwards of one metre per hour, that is, ten times the work of an ordinary boring rod.

"In the method I have described, it will be perceived that the water is injected through the interior of the boring rod. Experience has taught me that when gravel, or stones of some size are likely to be met with, it is better to inject the water by the bore-hole, and let it rise through the boring-tube. The additional velocity which may be thereby given to the water, and the greater accuracy of calibre of the tube, allow the free ascent of all substances which may be found at the bottom of the bore-hole, and which the former mode of working may not so readily accomplish.

"I have brought up by this latter way stones of 6 centimetre long and 3 thick (2¼ by 1¼ English inches).

"The idea of making the water ascend through the interior of the boring tube suggests an easy mode of boring below a film (sheet) of flowing water: it would be sufficient to close the orifice of the bore-hole hermetically, still, however, so as to allow the boring-tube to work, but yet so that the flowing water should be always forced down to the bottom of the bore-hole, to find its way to a vent; it would thus draw up and

carry away all the detritus. If in addition to the above we consider the possibility of making the hollow stem of the boring-rod of wood, and of balancing it so that it would weigh no more than the water in which it has to move, the problem of boring to depths of 1,000 metres (1,100 yards) and upwards would appear to be solved.

"In the square of St. Dominico, at Perpignan, a boring had been carried on upon the old method for upwards of eleven months for the purpose of forming an artesian well, and the water had not been found. Fauvelle placed his new tube alongside the old boring tackle, and soon got down to a depth of nearly 100 yards, when an accident occurred which would have required some days to remedy. Fauvelle decided upon abandoning the bore-hole already sunk so deep, and commenced a new one, satisfied that there would thereby be a saving in time. The rate of sinking was equal to four English feet per hour of the time the hollow boring-rod was actually at work, the depth of 560 English feet having been obtained in 140 working hours, for a bore-hole of about six English inches in diameter.

"M. Arago, who had seen the rods of Fauvelle at work; mentions how fully they answered, and that the large powerful tools at the bottom of the hollow boring-rod cut easily through the hardest strata; he confirmed the fact of the large-sized stones and gravel coming up with the ascending current, having himself watched them. He also mentioned, that such was the opinion of the people in the vicinity of Perpignan, and so much was water wanted, that orders for the sinking of upwards of 200 artesian wells had been given to Fauvelle. The introduction of this system into this country, especially if combined with the Chinese or percussive system of boring, as practised with bore-holes of a very large diameter, at the Saarbruck Mines, and at many other places on the Continent, must be productive of great benefit, and would not merely effect a saving of money and labour, but the paramount advantage of immediately solving the question of the existence of coal, minerals, water, &c."

A discussion arose on the reading of this paper, in which Sir John Guest, Dr. Robinson, the Mayor of Southampton, Mr. Roberts, and other gentlemen took part; the result of which was, the formation of a committee to inquire into its applicability to the boring for the Artesian well, now in progress on Southampton Common, and to make such practical arrangements for furthering that work as might be agreed upon.

NEW SUBMARINE BOAT.

Messrs. Payerne and Bouel, it is stated in the *Comptes Rendus*, of the Academié des Sciences, have placed the submarine boat they have caused to be constructed, and which has already been tried on the Seine, at the disposal of such philosophers and physiologists as may wish to make experiments requiring an apparatus of this nature, and who do not need pressure greater than that of the waters of the Seine at Paris. This vessel will shortly be sent to Brest, to proceed with the salvage of the guns of the Republican, sunk in 1793.

ON THE MANUFACTURE OF THREAD OR YARN AND FABRICS, FROM ABACA, NIPIS, AND PINA, INDIGENOUS TO MANILLA.

Abaca or Manilla hemp is the produce of a banana tree, indigenous to the Phillippine Islands, and known to botanists by the name of *musa troglodytarum*. It is cultivated, on a large scale, in the provinces of Camarines Norte, Camarines Sur, Albay (Island of Luçon), Samar, and Leyte,—Islands bearing those names.

For this purpose, the sides of mountains, newly cultivated, are preferred. The young plants, after having their tops cut off, are placed at a distance of fourteen feet apart, in holes about six inches square. During the first two years this plantation only requires weeding twice a year, in order to destroy the noxious weeds, which would soon kill the plants; in the course of the third year the largest stalks are cut. As the banana tree possesses the property of continually putting forth fresh shoots, the plantations will last for any length of time.

In order to prepare the *abaca*, the banana top is split into several long strips, which are passed between a thick plank placed in a horizontal position, and a metal blade pressed forcibly upon it; the strip is drawn through and in this manner scraped, and the fibres deprived of the pulpy integuments; they are afterwards dried in the sun, and are easily separated; it then only remains to sort them and tie them together.

It is calculated that a foot of banana will furnish from ten to twelve ounces of thread, and that one workman can prepare 50 lbs. of abaca per diem.

Before the year 1823, the production of abaca was of very little importance; not more than 200 lbs. per annum were exported. The quantity exported now is upwards of 2000 tons. Ropes, cordage, and various fabrics, are made with abaca. There is a rope

manufactory at Manilla, worked by steam, which furnishes a large quantity of ropes, &c., for maritime purposes. Cordage made from this substance does not shrink from damp; but this advantage is counter-balanced by several disadvantages, in consequence of which the abaca cordage is much inferior to that manufactured from hemp; for instance, the former is never so flexible nor so strong as the latter.

The abaca fabrics are a kind of transparent cloth, somewhat stiff, light, and very cool to the touch, from which the *Tagals* make coloured shirts. These fabrics are generally striped, and often printed; they might be used with advantage for sifting and straining purposes. Abaca thread does not require to be spun; it is used as produced by nature, and simply joined together end to end. The threads are tied together in bundles, and beaten, for the purpose of softening them, and afterwards bleached by immersion, during twenty-four hours, in lime water, and dried in the sun; they are then in a fit state for weaving.

A fabric, known under the name of *medriniac*, is also manufactured from unbleached abaca thread, which may be advantageously used for linings of clothes, &c.: this fabric is extensively used for these purposes in Spain.

From the finest abaca thread a pretty stuff, called *jusi* (housi), striped with various coloured silks, is manufactured. It is sold at the rate of two piastres every twenty tares, or about sixpence per yard.

Pina is a thread obtained from the leaf of the ananas or pine-apple; it is prepared in the same manner as abaca thread, great care being observed in picking or sorting before uniting them. This thread may be dyed.

Nipis, or vegetable silk, is a filament produced from the leaf of the *nipis* palm tree. A species of pina, of inferior quality, is made from this fibre.

The stuff known at Manilla by the name of *sinamaye* is manufactured from pina and silk, forming stripes of various sizes and colours. Ladies' dresses are made from it, and also fine shirts and stomachers.

CRIMINAL LUNATICS IN BETHLEM HOSPITAL.

Dr. Mayo makes the following observations, in the *Medical Gazette*, on the condition of the criminal lunatics in Bethlem Hospital:—

"A visit to the criminal department of Bethlem Hospital is productive at present of strange and painful associations in regard to the administration of justice in this country. Hatfield, so justly saved by the eloquence and wisdom of Erskine, is no more. Dalmas, the Battersea-bridge murderer, is removed by transportation—a sentence which, probably, was well adapted to the extent of his guilt; for there had been a heavy injury to his head in his early life, which might fairly be taken in extenuation as to the motives of his act, though the measures afterwards adopted by him for concealment showed that he was still susceptible of motives, and, therefore, a responsible agent. The Greenwich murderess is at present in Bethlem, where her case will afford very mischievous evidence to all such hysterical young females as may be cognisant of it, how comfortably life may be spent after the indulgence of splenetic cruelty, provided a human being is destroyed. There is not about her the smallest evidence of insanity.

"The Hon. Mr. Tucket, cool, indifferent, and self-possessed, enjoys there the immunity from punishment which a well-chosen counsel can at any time obtain for an eccentric culprit, when the punishment of death is manifestly too severe for the occasion, and yet nothing but the plea of insanity can avert it. Oxford has the frequent gratification of being stared at as the man who shot at the Queen. Captain Johnson's cold, close, subacid visage, and quiet, gentle demeanour, is awfully contrasted in our recollection with the demoniacal violence which drink and fear, operating upon cruelty, could produce in him, without the smallest warranty of insanity. While Macnaughten, the murderer of Mr. Drummond, a man really under the influence of monomaniacal impulses, is, in these walls, as certainly prevented from wild breaks of violence by a consciousness that they would be followed by a period of seclusion, as he might, perhaps, before have been, had the laws of his country, or, rather, the principle on which those laws are carried out, furnished him with more definite reasons for self-control."

ROYAL COLLEGE OF CHEMISTRY.

The annual general meeting of the members of this College was held on Monday, the 31st August, in the institution, Hanover-square. In the absence of the Earl of Clarendon, the chair was occupied by B. B. Cabbell, Esq., M.P., and supported by the Earl of Antrim, Sir J. Clarke, M.D., and other gentlemen.

The details of the report (the first presented to the members) bore reference more particularly to the positive transactions of the institution, than to matters of public

interest connected with the science of Chemistry.

Since the establishment of the College in 1844, the total receipts, including those for the purposes of the new building, amounted to 5,556*l.* 19s., and the disbursements to 4,517*l.* 5s. 9d., leaving a balance of 1,039*l.* 13s. 3d. The subscriptions, &c., amounted to 1,571*l.*, and the donations to 2,693*l.* 5s.; of the latter the sum of 100*l.* was received from His Royal Highness Prince Albert, and a like amount was also forwarded by His Royal Highness, as the representative of the Duchy of Cornwall. The donations to the building fund now amount to 1,763*l.*; but more than 2,000*l.* will be required for carrying out the objects in view. It appears that, with regard to the laboratory, the total cost of the building will exceed the original estimate, and will amount to 5,000*l.* Mr. Blakemore, M.P. for Wells, offered to supply 500*l.*, on fifteen other gentlemen subscribing 100*l.* each, and by this means the sum of 2,000*l.* was raised, under the denomination of the Blakemore Fund, being, it appears, distinct from the general building fund.

In the first year, the number of students was twenty-six, and in the last thirty-seven; fifteen having remained from the previous year. The fees paid by them amounted to 527*l.* 17s., the laboratory expenses to 921*l.* 13s. This department will be finally opened in October next. The report added, that through the instrumentality of His Royal Highness Prince Albert, negotiations had been concluded with the Prussian Government, by which, in the event of the College not succeeding, M. Hoffman will be permitted to continue his professorship at Bonn.

The report having been agreed to, the meeting proceeded to the election of office-bearers, when His Royal Highness Prince Albert was re-elected president.

The third practical course of scientific instruction in this institution, will commence on the 1st of October in the New Laboratory. The method of instruction is similar to that in use at Giessen. A working place is appointed for each student, who provides himself with the smaller apparatus, the cost of which is about 2*l.*

ELECTRIC EXCITEMENT OF PAPER.

BY THE REV. H. G. O. DWIGHT.

It is well known that friction will excite electricity in a sheet of paper, especially if it be thoroughly dry. This is well shewn by placing the paper on a warm stone, for a moment, when a single passing of the palm of the hand will produce electric excitement. On raising the paper carefully from the stone, sparks may be obtained from different parts of it by the knuckle. If a piece of tin plate be placed on the paper arranged on the stone, and pressed down, on raising the whole carefully, a strong spark is procured, and if it be returned to the stone, and the plate again pressed strongly upon the paper, another spark is given out on again raising it.

If the sheet of paper, with the tin plate mentioned above, be charged as just explained, and then be removed carefully, and placed on a sheet of tinfoil upon the top of an insulated stool, and pressed down with a finger at the centre,—on raising it, a strong spark will be obtained from the tinfoil, and another from the lower surface of the tin plate through the paper. This simple electrical machine may be again charged by returning the paper to the stone, and pressing the tin plate down upon it with the hand.

A CHEAP SUBSTITUTE FOR A VAPOUR-BATH.*

Dr. Serre (D'Alais) recommends the following means of inducing abundant transpiration:—

"Take a piece of quick lime, about half the size of your fist, and wrap around it a wet cloth, sufficiently wrung to prevent water running from it. A dry cloth is to be several times wrapped around this. Place one of these packets on each side the patient when in bed. An abundant humid heat is soon developed by the combination of the lime with the water, which quickly induces copious transpiration; the effect of the apparatus lasting for two hours at least. When sweating is fully established, we may withdraw the lime, which is now reduced to a powder, and is easily removed. In this way, neither copious drinks nor loading the bed with coverings is required."

ON THE MANUFACTURE OF ENAMELLED COPPER, AT CANTON.

When the copper has been shaped into the desired form, it is to be cleansed, but not scoured, and afterwards wetted with water, and sprinkled with the enamelling composition intended to form the ground, which may be either white or coloured: the article is then put into a muffle heated by means of dry Nankin coal (this is found to be the best fuel). When the ground has been produced,

* *Medico-Chirurgical Review.*

the article is withdrawn from the muffle and covered with an iron bell, in order that it may cool slowly: the ground may be then ornamented in the same manner as porcelain, and again passed through the muffle.

Several specimens of enamel, and colours upon enamel, have been deposited at the royal manufactory at Sevres, in order that the manufacturers in this kingdom may be made acquainted with the art.

REVIEW.

AN EASY INTRODUCTION TO CHEMISTRY. By Geo. Sparkes. Second Edition. Whittaker and Co., London.

We have already noticed the first appearance of this little work, in a former volume of the *Chemist*. The appearance of this second edition is a proof of the increased popularity of the science of chemistry, and on that account we hail the appearance of this introduction. The mode in which the author's purpose is carried out is as clear and intelligible as the subject will admit. It is, however, but another proof added to the many already on record, that there is no royal road to learning; but still, as an incentive to the study of the science, we can cordially recommend it to the public. The author's intention and mode of treating the subject may be better gathered from the following extract from his preface:—

"With respect to the supposed difficulties of chemistry, I would observe that, in consequence of the immense number of facts which have been discovered in the science, it is necessary for an author, who wishes that his work may embrace them all, to write in a systematic form, commencing with a description of the simple elementary substances, and gradually proceeding to shew the nature of their combinations. This synthetic arrangement is the only one by which such a mass of information can be clearly laid out on paper, or committed to memory. But, unfortunately, it is quite unsuited to beginners, who soon grow weary of lengthened descriptions of oxygen, hydrogen, and other invisible agents, and are too often induced to lay aside a study of which the commencement is so uninviting. I purpose, therefore, in the present course, to reverse the usual order of instruction, and to follow, as far as it can be done conveniently, the more natural and simple plan adopted by the older chemists, and again recommended by Whately, viz., to commence with the examination of common and familiar substances, and gradually proceed to the development of the more recondite elements. Advancing thus from things known to things unknown, the student will be following the same course which the science itself made in its infancy, and by which alone, even in the present day, all new truths must be discovered.

"After the foregoing observations it seems almost unnecessary to state that this work is intended solely for beginners. It lays no claim to originality, properly so called, and attempts nothing more than a judicious selection and combination of well-known facts. As it must always be a matter of opinion what should be inserted and what omitted, it is the misfortune of every elementary treatise that it is exposed to double censure, as being in the opinion of some too superficial, in that of others too scientific and elaborate. The author has endeavoured to keep the middle path; and the favourable reception which the public press gave to the first edition of this Work, encourages him to hope that his labour has not altogether been in vain."

TO CORRESPONDENTS.

"C. Taylor," (Lynn).—A very ably written paper on the subject referred to by our correspondent will be found in the *Lancet* of the 2nd of May last.

"T. G." (Hammersmith).—A proposal has been made by the "*Academie des Sciences*," to collect and republish the works of Lavoisier at the public expense; it is calculated that they will occupy 3,000 pages in 4to., and that the expense will amount to from 1,500*l.* to 1,600*l.*

"Student."—Impure samples of iodide of potash are to be met with, being adulterated by the addition of carbonate of potash. If this salt is dissolved in water, it yields, by the addition of lime-water, a white precipitate, which effervesces by the addition of sulphuric acid.

The article "On the Causes to which Musical Sound produced in Metals by discontinuous Electric Currents are attributable" has been accidentally misplaced by the printer, which will, however, be readily perceived by our readers.

"Mephistophiles."—The "guinea in advance" scheme, we believe, has *not* answered the expectations of the projectors.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month, Books for Review before the 10th.*

THE CHEMIST.

CHEMICAL NOMENCLATURE AND CLASSIFICATION; TO WHICH IS ADDED, AN HISTORICAL LEXICON OF SYNONYMES, INCLUDING THE ANCIENT NAMES, THE FORMULÆ, THE NEW NAMES, THE NAMES OF THE AUTHORS, AND THE DATE OF THE DISCOVERY OF THE PRINCIPAL PRODUCTS OF CHEMISTRY.

(*Continued from page* 441.)

BY FERD. HOEFER, DOCTOR IN MEDICINE.

LAVOISIER'S CLASSIFICATION.

LAVOISIER and Fourcroy, and Berthollet, nearly followed the classification of Morveau. In his *Traité Elementaire de Chimie*, the first work on scientific chemistry, Lavoisier seems to have classed bodies as *combustibles* and *non-combustibles*, but this classification is nowhere established in an explicit manner. Lavoisier, with good reason, prefers the term *oxigenable* to *combustible*, and he describes combustion by the term oxigenation; oxygen was therefore the combustible body, *par excellence*.

M. THÉNARD'S CLASSIFICATION.

Since the time of Lavoisier, it appears as if it were necessary to group every fact along with oxygen. This exaggeration of the part played by oxygen, is also met with in the classification proposed by M. Thénard, nearly thirty years ago. In this classification simple bodies are divided into *non-metallic* bodies or *metalloïds*, and *metallic* bodies or *metals*. The metalloïds are arranged in the order of their affinity for oxygen; the metals are divided into sections, according to the order in which they decompose water, at more or less elevated temperatures, that is to say, as they are more or less capable of oxigenation. [This last portion of M. Thénard's classification has been revised by M. Regnault, who has introduced several marked modifications.]

The following is the order of this classification, so ingenious on account of its simplicity.

SUPPORTER OF COMBUSTION.

Oxygen.

COMBUSTIBLE BODIES.—I. METALLOIDS.

Hydrogen, boron, silicum, carbon, phosphorus, sulphur, selenium, fluorine, chlorine, bromine, iodine, azote.

II. METALS.*

First Section.—Metals that decompose water at 42½° F., and oxidable at the ordinary temperature.—Potassium, sodium, lithium, barium, strontium, calcium, magnesium.

Second Section.—Metals not beginning to decompose water until at nearly 212° F.—Glucynium, aluminium, zirconium, thorium, yttrium, calcium, manganese.

Third Section.—Not decomposing water, until at a red heat, or in the presence of acids.—Iron, nickel, cobalt, zinc, cadmium, chrome, vanadium.

Fourth Section.—Metals decomposing water at an elevated temperature, but not decomposing it in the presence of energetic acids, and forming acids.—Tungsten, molybdenum, osmium, columbium, titanium, antimony, uranium.

Fifth Section.—Metals decomposing water very feebly, at an elevated temperature, and not forming acids.—Copper, lead, bismuth.

Sixth Section.—Metals not decomposing water at any temperature.—Mercury, silver, rhodium, iridium, palladium, platinum, gold.

Oxidation is, as we perceive, the sole and fundamental character of M. Thénard's classification. It is therefore an artificial classification, like that of Linnæus, in which plants are arranged after the single character of their sexual organs. Hence it results that bodies belonging to natural groups are separated from each other; this is an inconvenience which does not arise in a natural classification.

* The division of amphidate bodies, placed between the metalloïds and the metals, includes thorium and zirconium. This division appears to be entirely useless, because thorium and zirconium are found in the second section of the metals.

BERZELIUS'S CLASSIFICATION.

Like the preceding classification, that of Berzelius rests on a single character, ***electricity***, which here takes the place of chemical affinity.

M. Berzelius establishes it as a principle, that every chemical combination depends, solely, on two opposing forces, positive electricity, and negative electricity; that, consequently, every compound body, whatever in other respects may be the number of its constituent principles, may be divided into two elements, one of which is positively, and the other negatively, electrical. Thus, for example, chlorate of potash is composed of two elements, one electro-negative (chloric acid), and the other electro-positive (potash). In the same manner, chloric acid and potash are each composed of an electro-negative element (oxygen), and an electro-positive element (chlorine). In fact, chlorate of potash, submitted to the action of the pile, is decomposed; the electro-negative element (chloric acid) appears at the electro-positive pole, and the electro-positive element (potash) at the electro-negative pole. So also chloric acid and potash are decomposed in an analogous manner.

Electricity, therefore, according to M. Berzelius's theory, is the primary cause of all chemical action; it is the source of light and heat, which are only modifications of it. Finally, in every chemical combination there is a neutralisation of opposite states of electricity, and this neutralisation produces fire, in the same manner as it is produced in the discharge of the Leyden jar, and during thunder; only, in these last phenomena, there is no chemical combination.

M. Berzelius also observes, that the electrical order of combustible bodies agrees, in general, with that of their oxides, so that the degrees of oxidation of different radicals, have the same relation to each other as the radicals themselves.

Simple bodies, as in M. Thénard's classification, are divided into metalloids and metals. Selenium, arsenic, chrome, vanadium, molybdenum, tungsten, antimony, tellurium, titanium and tantalum are placed in the series of electro-negative metals; all the other metals are comprised in the series of electro-positive metals. All the metalloids are electro-negative, with respect to the metals.

The following is a table of simple bodies, arranged in electro-chemical order:—

Oxygen	Titanium	Nickel
Sulphur	Silicium	Iron
Nitrogen	Hydrogen	Zinc
Fluorine	Gold	Manganese
Chlorine	Osmium	Cerium
Bromine	Iridium	Lanthanum
Iodine	Platinum	Thorium
Selenium	Rhodium	Zirconium
Phosphorus	Palladium	Aluminum
Arsenic	Mercury	Yttrium
Chromium	Silver	Glucynum
Vanadium	Copper	Magnesium
Molybdenum	Uranium	Calcium
Tungsten	Bismuth	Strontium
Boron	Tin	Barium
Carbon	Lead	Lithium
Antimony	Cadmium	Sodium
Tellurium	Cobalt	Potassium
Columbium		

In this scale of electro-chemical relations, the most electro-negative bodies are placed first, and the most electro-positive last. These are, so to speak, the two opposite extremities of the pile. The intermediate substances are so arranged that that which precedes another is always electro-negative, with respect to that which follows; and, inversely, every substance is electro-positive in respect to that which precedes it.

This classification has rendered great services to nomenclature, with which it is closely connected. Formerly, for example, we said indifferently, sulphuret of carbon, or carburet of sulphur. M. Berzelius's classification has established, as a rule, that in the union of an electro-negative with an electro-positive body, the first forms the generic name, and the last the specific. According to this rule we always say, sulphuret of carbon, chloruret (chloride) of phosphorus, phosphuret of arsenic, &c.

M. Berzelius has given the name of ***halogens*** (from ἅλς, ***salts***, first applied to sea salt, chloride of sodium, and of γίνομαι, *I am born from*) to these simple bodies, which, like chlorine, bromine, iodine, fluorine, &c., combine, directly, with the metals, to produce substances having the appearance of salt; and he applies the name ***amphigens*** (from ἀμφί *around, on two sides*, and of γίνομαι), to substances, which, like the oxacids, only combine with a metal previously oxidated, to form a saline product.

CLASSIFICATION OF COMPOUND BODIES.

1. Binary compounds of the first order, ***oxides***, ***superoxides***, and ***acids***.

2. Binary compounds of the second order, ***salts***.

3. Binary compounds of the third order, ***double salts***.

4. Binary compounds of the fourth order, ***double hydrated salts***.

All compounds are considered binary, inasmuch as when submitted to the action of the pile, they are decomposed into an electro-negative and electro-positive element; but

we must not lose sight of the fact, that each of these elements may be very complex when considered in a chemical point of view.

Many objections have been raised against the classification of M. Berzelius. One of the most serious charges that can be made against him is, the relying on a principle, the nature of which is at present a subject of controversy. Even the terms positive and negative electricity, indices of an antagonism rather apparent than real, will, in the end, disappear from science. It is the same principle seen under different phases. This is so true that any electro-negative body in the series established by M. Berzelius may, under certain circumstances, be positively electrical, and *vice versa;* thus, for example, hydrogen can, according to the experiments of M. de la Rive, appear indifferently at the positive or negative pole.

AMPERE'S NATURAL CLASSIFICATION.

Ampere was one of the first to attempt to introduce into chemistry the method of natural classification, in which bodies are divided neither into metals and metalloids, but into *mineralising* and *mineralisable* bodies. We shall speak, further on, of the advantages of a classification of this description, but we shall confine ourselves at present to point out the plan traced by Ampere.

Simple bodies are divided into three classes—*gazolytes*, *leucolytes*, and *chroïcolytes*. The gazolytes have the distinctive character of forming, by their reciprocal combination, permanent gases, which can exist in contact with air.

These names have the following derivations:—Gazolytes from *gas* and λύω, I *dissolve*, that is to say, bodies producing gaseous compounds; leucolytes from λεῦχυς, *white*, and γῦω, bodies forming white (colourless) solutions; chroïcolytes from χρῶμα, colour and λῦω; that is, bodies which form coloured solutions.

The leucolytes do not form permanent gases. They melt below 25 of Wedwood's pyrometer, and produce, with colourless acids, solutions, also colourless. The chroïcolytes do not form permanent gases, they are only fusible at above 25 of Wedgwood's pyrometer; they generally produce coloured solutions with acids.

These three classes include fifteen genera, of which the following is a list:—

FIRST CLASS.—GAZOLYTES.

1. *Borides.*—Boron, silicium.
2. *Anthracides.*—Carbon, hydrogen.
3. *Thionides.*—Sulphur, azote, oxygen.
4. *Chlorides.*—Chlorine, phthorine, iodine.
5. *Arsenides.*—Arsenic, tellurium, phosphorus.

SECOND CLASS.—LEUCOLYTES.

6. *Cassiterides.*—Tin, antimony, zinc.
7. *Argyrides.*—Silver, bismuth, mercury, lead.
8. *Tephralides.*—Sodium, potassium.
9. *Calcides.*—Calcium, strontium, barium, magnesium.
10. *Zirconoides.*—Zirconium, aluminium, glucinium, yttrium.

THIRD CLASS.—CHROICOLYTES.

11. *Cerides.*—Cerium, manganese.
12. *Siderides.*—Iron, copper, nickel, cobalt, uranium.
13. *Chrysides.*—Gold, platinum, palladium, rhodium, iridium,
14. *Titanides.*—Titanium, osmium.
15. *Chromides.*—Chrome, tungsten, columbium, molybdenum.

M. Ampere's classification has been adopted, with a few slight modifications, by M. Despretz, in his "Elements of Theoretical and Practical Chemistry."

In 1828, M. Pauquy made a few attempts at a natural classification, which, in more than one respect, leaves much to desire.

M. BAUDRIMONT'S CLASSIFICATION.

In his "Treatise on General and Experimental Chemistry," M. Baudrimont has proposed a classification of substances in natural groups, which, we think, ought to be noticed.

Chemical elements, classed in a linear and united series, as much as possible, according to their natural affinities.

1. *Hydroides.*—Hydrogen, carbon.
2. *Oxoides.*—Oxygen, sulphur, selenium.
3. *Chloroides.*—Chlorine, bromine, iodine, cyanogen, fluorine.
4. *Azoloides.*—Azote, phosphorus, arsenic, antimony, bismuth.
5. *Boroides.*—(Borides)—Boron, silicium. (Aluminides or glucides)—Aluminium, glucynium, zirconium, thorium.
6. *Chromoides.*—(Chromides)—Chromium, vanadium. (Molybdides)—Molydenum, tungsten.
7. *Sideroides.*—(Ferrides)—Iron, manganese, uranium. (Cerides)—Cerium, lanthanum, yttrium, columbium.
8. *Cuproides.*—Cobalt, nickel, copper.
9. *Zincoides.*—Magnesium, zinc, cadmium.
10. *Calcoides.*—Calcium, strontium, barium, lead.
11. *Natroides.*—(Kalides)—Potassium, lithium, ammonium. (Natrides)—sodium.
12. *Argyroides.*—(Argyrides)—silver. (Chrysides)—gold, mercury.
13. *Platinoides.*—(Platinides)—palladium,

Platinum. (Osmides)—rhodium, iridium, osmium.

14. *Stannoides.*—Tin, titanium.

The establishment of the sub-orders of the natrides, and argyrides, each of which contains a single substance only, is a proof of the inherent difficulties of a task of this nature. In chemistry, as in other natural sciences, it is always an inconvenience to be obliged to establish some particular genus, for the purpose of classifying a single species. According to this plan it would have been necessary also to form a peculiar genus for hydrogen, and for carbon, two bodies which differ from each other, at least to as great an extent as potassium and sodium.

M. DUPASQUIER'S CLASSIFICATION.

In a work recently published, M. Dupasquier has established a classification which, also, rests on the grouping of bodies in natural families. This classification is peculiarly distinguisgued from all others, because it unites oxygen, azote, hydrogen and carbon, in a single group, under the name of *organogens.*

The division of simple bodies into metalloids and metals is preserved.

The metalloids are divided into four groups or sections.

1. *Organogens.*—Oxygen, azote, hydrogen, carbon.

2. *Sulphuroids.* — Sulphur, selenium, phosphorus.

3. *Chloroides.*—Fluorine, chlorine, bromine, iodine.

4. *Boroids.*—Boron, silicium.

The metals are divided into six sections, which the author intends to describe in the second volume of his work.

M. HOEFER'S CLASSIFICATION.

In a work published in 1841, I, myself, proposed a classification, the principles of which rested on the chemical properties of bodies, and on isomorphism, on which subject the excellent experiments of M. Mitscherlich have thrown so much light.

The following is the order of natural families, which I have endeavoured to establish, together with a list of the simple bodies belonging to each family:

Oxacés.—Oxygen, sulphur, selenium, tellurium.

Chloracés.—Chlorine, bromine, iodine, fluorine, cyanogen.

Carbacés.—Carbon, boron, silicium, titanium, tantalum, hydrogen, azote.

Phosphacés.—Phosphorus, arsenic, antimony.

Kaliacés.—Potassium, sodium, lithium, ammonium.

Baryacés.—Barium, strontium, calcium, magnesium, lead.

Aluminiacés.—Aluminium, glucynium, yttrium, thorium, zirconium, cerium, lanthanum.

Ferracés.—Iron, manganese, chromium, cobalt, nickel, zinc, cadmium, copper.

Hydragyracés.—Mercury, bismuth.

Stannacés.—Tin, molybdenum, tungsten, uranium, vanadium.

Auracés.—Gold, silver, platinum, palladium, rhodium, iridium, osmium.

[I have preferred giving to the families the termination *acés*, because *acea* reminds one of the families established in botany and zoology. Cyanogen is placed among simple bodies, because, although it is really a compound body, it acts like a simple substance. The same remark is applicable to ammonium, in the family of the kaliacés.]

In this attempt at a classification, which I am far from laying down as perfect, hydrogen and azote are placed between the carbacés and phosphacés, without strictly belonging to either. I am also the first to acknowledge, along with M. Baudrimont, that the group of carbacés is disconnected, and I yielded to his advice by placing azote in the family of the phosphacés, zinc next to magnesium, and tin by the side of titanium.

The utility of a natural classification is incontestable, we may regard it in four different lights.

1. This mode of classification powerfully assists the memory; and, consequently, facilitates the study of chemistry. In this manner, by means of any particular body which may be considered as the type of a family, we shall be acquainted beforehand, to a certain extent, with the properties of other bodies belonging to the same family. For example, a knowledge of sulphur almost enables us to guess at the essential characters of selenium and tellurium; as in botany, the blossom of the stock reminds us of that of the cabbage, the radish and mustard; in fact, of all the plants contained in the cruciform family.

2. The existence of some peculiar substance causes us to conclude in the existence of other bodies of the same family in the same situation; thus in botany, the presence of a plant of the family *Labiatæ*, enables us to suspect the presence of other plants of the same family. This, perhaps, is more generally true in mineralogy than in botany. Wherever we meet with chlorides we may readily discover iodides and bromides. Sulphur frequently is accompanied by selenium.

3. Bodies of the same family usually possess analogous properties, and we may substitute many of these bodies for each other

when employing them. Thus, the iodides and bromides can, in many cases, be employed for the same purposes as the chlorides. The compounds of selenium could replace those of sulphur. For a similar reason the most natural families in botany possess similar medicinal properties, and the difference rests not on the kind but on the amount of action. Thus the mallow tribes are mucilaginous, the cruciferous plants antiscorbutic, the labiatæ aromatic and exciting.

4. Finally, the classification of bodies by natural families, enables us to understand at a glance, as it were, not only what has been done, but what remains to be accomplished in the way of discovery. It encourages the spirit of research, and assists in filling up the *lacunæ* which still exist in science.

CHAPTER IV.—CONTINUATION OF ORGANIC CHEMISTRY.

Organic chemistry was left untouched in the revolution produced in the science by Lavoisier, at the end of the eighteenth century. The Guytonian nomenclature, founded on the principle of dualism, is only applicable to mineral chemistry, as we have previously shown. It is the same in respect to the classifications we have just described.

On the other hand, the classifications proposed in the case of organic chemistry, are inapplicable to mineral chemistry. Here, then, is an immense *saltus* between organic and mineral chemistry, making use of an expression of Linnæus. Excluding the analytical knowledge, with which the ancients were unacquainted, we are scarcely further advanced at the present day, as far as relates to a general system of organic chemistry, than we were in the days of Lemery, Lefebvre, and Rouelle, or even before the time of those chemists. Each chemist invents and adopts the system he finds most in harmony with his own theoretical or speculative views. The anarchy that formerly reigned, reigns at the present day. Lavoisier shrunk from the task of forming a system for compound organic bodies, for want of analytical knowledge. It was a task he bequeathed to his successors.

One of the most eminent men and most fitted for this important task is M. Dumas.

CHEMICAL TYPES.—M. DUMAS' CLASSIFICATION.

The *theory of substitutions* precede classification by types; it is, therefore, indispensable to say a word on the theory, which has been the object of such lively controversy. A few facts will explain it better than an abstract definition.

Acetic acid $C^4 H^3 O^3$ brought into contact with dry chlorine, in a direct light, loses all its hydrogen, which is found to be replaced by an equal quantity of chlorine, expressed in equivalents: so that instead of $C^4 H^3 O^3$ (acetic acid) we have $C^4 Cl^3 O^3$; this new compound is also acid, it is chloracetic acid; it forms with oxide of silver, a chloracetate of silver, analogous to the acetate.

When we pass a current of chlorine through pure alcohol, we obtain a neutral compound, like alcohol, which is called chloral. In this compound 3 equivalents of hydrogen have been exactly replaced by 3 equivalents of chlorine.

The *liqueur des Hollandais* (chlorated ether) $C^4 H^3 Cl$ is merely olefiant gas, in which 1 equivalent of hydrogen has been replaced by one equivalent of chlorine.

These facts, added to several others, to which it would be useless to refer, led M. Dumas to formulate, in the following manner, the principles of *metalepsy*, a name which he now prefers giving to the theory of substitutions,

1. When a hydrogenated body is submitted to the dishydrogenating action of chlorine, bromine, iodine, oxygen, &c., for each equivalent of hydrogen it loses, it gains 1 equivalent of chlorine, bromine, &c.

2. When the hydrogenated body contains oxygen, the same principle is observed without modification.

3. When the hydrogenated body contains water, the latter loses its hydrogen, which is not replaced, and after that point, if we remove from it another quantity of hydrogen, the latter is replaced as in the former cases.

4. In the midst of all the substitutions, a compound molecule can undergo, when all its elements have been replaced successively by others, as long as the molecule is intact, the substances obtained always belong to the same natural family.

5. When, by the effect of substitution, one body is transformed into another which exhibits the same chemical reactions, the two products belong to the same genus.

Alcohol, hydrated acetic acid, and chloracetic acid belong to the same natural family, acetic acid and chloracetic acid belong to the same genus.

The adversaries of M. Dumas are unwilling to discover in the theory of substitution any other than a peculiar case of the law of equivalents. Others, merely Berthollet's law, applied, with a few modifications, to organic chemistry. (Berthollet's law is thus formulated: when we mix two salts dissolved in water, and when, by their reaction, it is possible to form a soluble and an insoluble salt, or two insoluble salts, these salts are always

decomposed; that is, the acid of one combines with the base of the other, and reciprocally, unless a double soluble salt can be formed). Everybody has appeared to be ignorant of, or has not recognised, the true meaning of the theory of substitutions. This theory signifies, in fact, that the dualistic antinomy of the electro-chemical theory, is inadmissible, at least in organic chemistry. In fact if it be true, a fact which is indisputable, that chlorine, an electro-negative element, can, for example, take the place of the whole of the hydrogen the electro-positive element of acetic acid, and give birth to an acid (chloracetic acid), perfectly analogous to acetic acid, it is evident that the electro-chemical theory is contradicted by experiment.

We have to discover whether a chemical combination constructs, so to express ourselves, a simple edifice, according to the doctrine of M. Dumas, or a double structure, according to the electro-chemical theory. This was the gist of the question. This was precisely the ground on which the adversaries of the theory of substitutions avoided entering into the dispute.

The establishment of types was the natural consequence of the theory of substitutions.

M. Dumas gives the name type to a system of molecules, in which one or more molecules can be exchanged for others, without changing the chemical nature of the entire system. He proposed to include in the same *genus* all the compounds that united similar formulæ with the same chemical properties. Thus it is, that oxalic acid, and the oxalates, belong to the same genus. The *species* is determined by the base of each oxalate.

A series of papers of the highest interest has been devoted to this subject (*Annales de Physique et de Chimie*, tom. lxxiii, p. 73, *ibid*, p. 113; tom. lxxiv, p. 5. New series—tom. ii., p. 204; tom. v., p. 353.)

It is thus M. Dumas expresses himself at the beginning of the first memoir on chemical types:—"If we consider the various chemical compounds as forming so many planetary systems, composed of particles supported by different molecular forces, the result constituting affinity, we no longer perceive the necessity of this universal application of the law of dualism, formulated by the electro-chemical theory of Berzelius. The particles may be more or less numerous, they will be either simple or compound, they would perform the same parts in the constitution of bodies as is performed in our planetary system by the simple planets; like Mars or Venus, or compound planets, like the earth, with her moon; or Jupiter, with his satellites.

[It is curious to observe here how these ideas remind us of the doctrines of the ancients on *microcosm* and *macrocosm*. These ideas are revived in every age under different forms, and form, as it were, a fixed centre round which science gravitates.]

"Let us substitute in a system thus constituted, one particle for another of a different species, a new equilibrium will necessarily be established; the new body will resemble the first, or rather, it will only differ from it more or less by its external reactions. If the difference is little or none, the two bodies will possess the same chemical properties; if it is more strongly marked, they will still belong to the same mechanical system, but the chemical resemblance will be more difficult to appreciate.

"Experiment can teach us whether, in a given compound, complex groups enter, performing the function of an element. It will be sufficient to be satisfied of this, to be able to substitute elements for these groups, without altering the general constitution of the compound. Thus it is, that certain organic radicals really perform the part of simple elements, by which we may replace them in the compounds that contain them.

"Experiment can also teach us whether two bodies do or do not belong to the same chemical system; for in that case all the external reactions and the principal decompositions ought to have a perfect resemblance.

"I leave it to those to whom it belongs the task of establishing, by a series of experiments, that it can be demonstrated that two bodies also belong to the same mechanical system, although they differ from one another in all their apparent chemical properties."

What I wish, above all, to place in evidence, is the great value of these chemical properties, which I call fundamental, and by means of which we can demonstrate that two compounds, very different in appearance, belong, nevertheless, to the same chemical type; that is to say, that they are formed of the same number of equivalents, united in the same manner.

The foundations of the edifice are laid; but the skilful architect appears at present to have drawn back in presence of the details of the execution. The five memoirs on types contain excellent materials, although the definitive constitution of the types is not to be found clearly formulated in any part of the work.

M. GERHARDT'S CLASSIFICATION.

One of the most distinguished of M. Dumas' pupils, M. Gerhardt, has just proposed a classification, which agrees in many respects

with the principles established by M. Dumas. We shall only, in this place, give a rapid sketch of it, the work in which it will be found explained not being yet completely finished.

"When we consider," observes M. Gerhardt, "organic substances with regard to their combustion, we see that they offer successive gradations, so as to form an immense scale, the two extremities of which are occupied; on the one hand, at the summit, by cerebral matter, albumen, fibrin, and other more complex substances; and, on the other hand, at the bottom, by carbonic acid, water, and ammonia, themselves preceded by wood spirit, formic acid, and their derivatives. An infinity of gradations occupy the interval between these two extremities. The chemist, by employing the acid of combustion in the case of substances placed in the upper divisions, descends the scale, that is to say, he simplifies these substances by degrees by burning, successively, a part of their carbon and hydrogen; on the contrary, he reascends the scale by applying the processes of reduction to organic substances.

These are the ruling ideas of M. Gerhardt's classification. This classification may be defined as "the distribution of homologous bodies according to their carbon." M. Gerhardt means, by homologous bodies, substances that possess the same chemical properties, and whose compositions offer certain analogies in the relative proportions of the elements. Thus, for example, formic acid (CH^2O^2), acetic acid ($C^2H^4O^2$), valerianic acid ($C^5H^{10}O^2$), ethalic acid ($C^{16}H^{32}O^2$), are homologous bodies, and possess the same chemical properties; they all contain 2 equivalents of oxygen, in all of them the carbon and the hydrogen are met with in the proportion of 1 to 2. In addition to this, the mode of their formation is analogous. Formic acid is derived from the oxigenation of wood spirit in the same manner as acetic acid is formed from the oxigenation of spirits of wine, valerianic acid from oil of potatoes, ethalic acid from ethal. Finally, if we treat the four homologous bodies with chlorides, the wood spirit becomes hydrocholrate of methylen, $C H^2 + H Cl$; spirit of wine, hydrochlorate of etheren, $C^2 H^4 + H Cl$; oil of potatoes, hydrochlorate of amilen, $C^5 H^{10} + H Cl$; ethal, hydrochlorate of ceten, $C^{16} H^{32} + H Cl$.

According to this, the organic scale is composed of a certain number of degrees, the ranks of which are determined by the number of equivalents of carbon contained in a molecule of the substance. Wood spirit, formic acid, &c., are placed at the first degree, their compounds immediately preceding mineral substances, water, carbonic acid, and ammonia, products of the destruction of every kind of organic matter. Spirits of wine, acetic acid, &c., are placed at the second degree; oil of potatoes and its derivatives at the fifth; and ethal and bodies derived from it at the sixth, and so on.

In this manner we construct a real scale of combustion, indicating the species of the reagents the chemist ought to employ in his attempts at artificial reproduction

Two grand principles regulate this classification.

1. When homologous substances are decomposed into other homologous substances, the first give up, or fix, atomically, the same quantity of carbonic acid, water, oxygen, &c., to whatever degree of the scale they belong.

2. In homologous bodies the combustible elements, carbon and hydrogen, greatly vary as to their proportions, while oxygen, the element of combustion, as well as azote, are always atomically the same.

The normal proportion of 1 to 2 of carbon and hydrogen, is represented by the symbol R. In the case of those bodies where the proportions of carbon and hydrogen are as 1 to >2, R has attached to it an exponent, indicating the number of equivalents of hydrogen in excess, and preceded by the sign + : for bodies in which the proportion is as 1 to <2, R has a similar exponent attached, but preceded by the negative sign —, to indicate the number of equivalents of hydrogen minus.

Thus, wood spirit $C H^4 O$, alcohol $C^2 H^6 O$, oil of potatoes $C^5 H^{12} O$, ethal $C^{16} H^{34} O$, are homologous bodies of the form $R + O$.

Oxalic acid $C^2 H^2 O^4$, succinic acid $C^4 H^6 O^4$, pimalic acid $C^7 H^{12} O^4$, suberic acid $C^8 H^{14} O^4$, &c., are homologues of the form $—R^2 O^4$.

The name family is, in M. Gerhardt's classification synonymous with degrees. The 1st, 2nd, and 3rd families indicate so many degrees. The bodies belonging to the same family are never homologous.

This classification, at the same time, implies several modifications of nomenclature, which it is important to notice.

The compounds of carbon and hydrogen generally terminate in *ene* [*en*]. Examples: *formène* ($C^2 H^6$); *acetène* (Lœwig's ethal, $C^2 H^6$); *ptélène*, *butyrilène*, &c. The names with this termination form the *genera*.*

The *species* is indicated by an adjective placed immediately after the substantive

* The termination *ol*, is usually applied to oxigenated and volatile substances, such as the essential oils.

name of the genus. This adjective expresses the number of equivalents of chlorine, bromine, iodine, or fluorine, taking the place of the hydrogen; or the number of equivalents of metal replacing this hydrogen in saline genera; or the number of equivalents of sulphur, selenium, &c., replacing the oxygen, or, finally, in the combinations of acids with alkaloids the name of the acid.

Example:—

SPECIES OF THE GENUS FORMÈNE.

Old Names.

Normal formène $C H^4$,
Chlorated formène $C (H^3 Cl)$,
Bichlorated formène $C (H^2 Cl^2)$,
Trichlorated formène $C (H Cl^3)$,
Iodo-bichlorated formène $C (H I Cl^2)$,

New names.

Gas of the marshes [carburetted hydrogen],
Hydrochloric ether of méthylène,
Hydrochloric ether of mono-chlorated méthylène,
Chloriform,
Iodo-chloroform.

It is to be regretted that M. Gerhardt's classification does not possess that simplicity of character which ensures every invention a certainty of duration. If Linnæus's classification has survived other more natural classifications, it is because its simplicity makes it intelligible to all capacities, and that it is not even necessary to be a botanist to understand it, and make an immediate application of it. No classification founded on complex ideas has any chance of being established. Idleness is a vice naturally inherent in the mind of man.

A rather serious objection may be made to M. Gerhardt's classification—namely, that it is only applicable to a small number of compounds, in comparison with those which still remain to be classified or discovered. This is what M. Gerhardt himself appears to have perceived when he said "The classification of organic substances would be extremely easy if we were acquainted with all the bodies resulting from the decomposition of a single substance, all whose homologues should be known; but, unfortunately, the whole of our knowledge is deficient in this respect.

Another inconvenience of this classification is, that substances having much resemblance in their physico-chemical properties, are separated to a great distance from each other. This inconvenience is not remedied by several small and ingenious groupings, which, in reality, comprise but a small number of very restricted facts.

M. LIEBIG'S CLASSIFICATION.

M. Liebig considers that organic combinations are derived from a *radical*, either real or hypothetical. "Along with each substance are arranged those which arise from its partial composition, and in this manner we unite very distinct groups, certain individuals of which can often be deduced from other radicals, and, consequently, belong to two or more distinct series.

RADICALS THAT PRODUCE ACIDS.

Oxide of carbon, cyanogen, mellon, benzoile, cinnamyle, salicyle, acétyle, formyle.

RADICALS THAT GIVE RISE TO BASES.

Amides, ethyle, methyle, cetyle, glyceryle, amyle.

One of the most serious objections that can be made to this classification is, that almost all these radicals are creatures of the imagination. But M. Liebig himself has dealt a mortal blow to his own classification by abandoning it in the second volume of his "Treatise on Organic Chemistry," after having established it and acted on it in the first.

M. Laurent has broached, on different occasions, peculiar ideas on the nomenclature and classification of bodies, but as these ideas have not been clearly formulated in a collected form, it is impossible for me to describe them in this place.

CHAPTER V.—ON THE STATE AND ON THE MOLECULAR CONSTITUTION OF BODIES—LAW OF EQUIVALENTS—FORMULÆ.

All substances in nature are indebted for their physical properties to the ordinary conditions in which the globe we inhabit is placed. The ordinary conditions in which our globe is placed are, atmospheric pressure, the force of attraction, temperature, electricity, light, in fine, all those natural agents that are capable of powerfully modifying the nature of bodies submitted to our observation.

Why are the bodies with which we are surrounded, some solid, others liquid, and others gaseous? It is because the conditions of the atmosphere to which they are subjected are such, that the bodies we look on are, according to certain laws, either solid, liquid, or gaseous. Thus prussic acid is a gas to the inhabitants of Senegal, but a liquid to us inhabitants of the temperate zone. The Greenlander speaks of chlorine as a liquid of a yellowish colour, while the same body always appears to us under the form of a gas. For six months in the year, the Laplander only sees water under the form of ice, and the inhabitant of the torrid zone is only acquainted with water in that state by the reports of travellers. What would be the case if, for example, the ordinary temperature of the globe was at 212° below zero, and the

pressure of the atmosphere ten times greater than it is at present? Bodies which now appear liquid to us, would then become solid, and many gases would become liquid. Mercury would have the appearance of lead, and carbonic acid would flow like an essential oil. And if the ordinary temperature were 212° F., and the pressure of the atmosphere the one-fourth what it is at present, water, alcohol, &c., would be gases, while phosphorus, sulphur, &c., would become liquid bodies. Finally, neither the present organisation of man nor that of any other living being, would be able to exist under such circumstances.

What we have applied on a grand scale, the chemist executes in a small way, in his laboratory. The chemist does not create matter, but he greatly modifies the bodies on which he operates—he makes them solid, liquid, and gaseous.

(To be continued.)

EXPERIMENTS ON DIGESTION.*

BY M. BOUSSINGAULT.

In the course of my researches on the development of fat in animals, I had occasion to show, that rice, taken out of the gizzard of a duck, gave out to ether an evidently larger quantity of fat than it contained before it had been inclosed in that stomach. This observation was, however, of little importance, because this increase in the proportion of the fatty principle might arise from the starch having been more rapidly absorbed than the oil, which would be, to a certain extent, concentrated in that part of the food which, up to that time, had resisted the digestive process. Nevertheless, having since then discovered that the chyme of the small intestines of the same animal contained nearly five per cent. of fat, while the digested rice only included a few thousandths, I thought it right to examine these facts attentively; for not only did they show that different direct principles are absorbed by the digestive organs with very different powers; but they were also of a nature to induce a supposition that, under certain circumstances, fat, separated from the products of digestion, might well exceed that which is found in the food, and, in that case, we should have to endeavour to discover whether the fatty matter was derived from the fecula or the albumen, both of which enter into the composition of rice.

Such are the motives that caused me to undertake the experiments, the result of which I am about to relate. In executing them I particularly kept in view the comparison of the weight of the alimentary substances taken into the duodenum with that of the matter either digested or in the course of digestion, for the purpose of concluding, by the difference, that of the matter assimulated in the organism or eliminated by respiration, it appears to me that the consequences at which I have arrived ought to throw some light upon several, hitherto, obscure points on the subject of nutrition.

My observations were made on ducks. In experiments of this nature there is a great advantage in being able to ingest the food, leaving nothing to the will of the animal, in which the repugnance to feed on this, or that species of nourishment, is not always surmounted by the feeling of hunger.

The plan I have generally adopted, is, to to deprive the ducks of food for six-and-thirty hours, letting them have as much water as they like; we then cram them, and afterwards place them in a box in such a manner as to make it an easy task to collect the ejected matters. After a certain number of hours, stated in the description of each experiment, we kill the animal, and remove from the different organs the substances that are found in them. We weigh these substances, before and after their desiccation, and they are afterwards treated with ether; we act on the residue left by the ethereal solution, by means of hot water, to remove the soluble substances; it is then, only, we weigh the fatty matter, after having perfectly dried it. The ejections, always extremely watery, are calculated in a dry state, and being washed and dried again, we treat them with ether: sometimes we extract uric acid from the residue that is insoluble in water.

To attain the end I proposed to myself, it became indispensable to ascertain, for the purpose of taking it into account, the matter contained in the intestines, at the commencement of each experiment, when the animal has passed a day and a half without eating; I was also obliged to determine the weight of the ejections during the period of fasting, and calculate the fat contained in these substances. These preliminary experiments enabled me to prove this curious fact, that a bird that partakes of water only, has, nevertheless, a quantity of a dry substance in its intestines, which does not much differ from that which is found when the animal is well fed.

FIRST EXPERIMENT.

A Duck killed after six-and-thirty hours' fast.—We found in the duodenum, a very small quantity of a yellow, glutinous, and acid substance; and in the gizzard, a few grains of sand. The small intestine was filled

* *Comptes Rendus.*

with a substance of a brownish colour, very homogeneous, sensibly acid, and of the consistence of honey; the large gut and the cloaca were nearly empty. The cœca contained a rather fluid substance, of a dark green colour and a fetid odour. The excrements voided during the last four-and-twenty hours weighed, when dry, 2 grs. ·74. We extracted—

	Wet. gr.	Dry. gr.	Fat. gr.
From the duodenum, gizzard and intestines	10·82	2·29	0·105
Excrements in four-and-twenty hours	—	2·74	0·055
Normal fat			0·060

SECOND EXPERIMENT.

A Duck killed after six-and-thirty hours' fast.—We extracted—

	Wet. gr.	Dry. gr.	Fat. gr.
From the duodenum and gizzard	1·40	0·30	0·145
,, ,, intestines	9·10	2·20	
The cœca (a green alkaline substance)	1·29	0·21	traces of
Excrements in four-and-twenty hours	—	2·71	—
Insoluble portion of the excrements	1·19	—	0·031
Soluble portion	1·52	—	—
Normal fat			0·176

From the insoluble portion of the excrements we extracted 0gr.·27 of uric acid.

THIRD EXPERIMENT.

A Duck killed after six-and-thirty hours' fast.—We extracted—

	Wet. gr.	Dry. gr.	Fat. gr.
Duodenum, gizzard, and intestines	10·00	2·10	0·12
Excrements in four-and-twenty hours	—	2·80	0·05
Normal fat			0·17

FOURTH EXPERIMENT.

A Duck crammed with Clay.—In this experiment I endeavoured to discover whether the ingestion of an indigestible substance would excite an intestine secretion, more charged with fat than that previously obtained.

A duck, deprived of nourishment for thirty-six hours, was crammed, twice, with small balls of moist clay. Five hours after the first ingestion, the clay began to be evacuated under the form of long cylinders, accompanied by a yellow, acid, and very abundant liquid. The duck was killed four-and-twenty hours after the beginning of the experiment. We extracted—

	Wet. gr.	Dry. gr.	Fat. gr.
From the duodenum and gizzard	—	—	—
Substances in the intestines and cœca	11·45	2·85	0·125
Ejections	—	18·40	0·055
Normal fat			0·180

The fat obtained under these circumstances did not differ in quantity from that which was extracted in the three first experiments.

The average quantity of fat extracted from the digestive apparatus of a duck after fasting thirty-six hours, is represented by— 0·17
Dry intestinal matter .. .. .. 2·36
Dry ejections, yielded in twenty-four hours, by .. .. 2·75
Uric acid in these ejections (one determination), by .. .. 0·27

In what follows, I shall admit, as constant, the numbers expressing the quantity of fat, and that of the intestinal matter; the weight of the normal ejections will be corrected according to the duration of the experiments.

FIFTH EXPERIMENT.

A Duck crammed with Rice.—At half-past seven in the morning, we crammed a duck with 71 grammes of whole rice, which had been soaked in water. In the evening, at the same hour, we again injected 80 grammes of rice; the rice in the state in which it was ingested, contained 0gr.·864 of dry substances, and 0gr.·004 of oily matter, the whole of the dry rice submitted to digestion, deducting that found in the œsophagus, was, consequently, 112gr. ·32: in the duodenum the aliment was still recognisable, each grain being found enveloped in a viscous liquid, of a yellow colour, and with an acid reaction; in the gizzard there was a paste of the same colour, homogeneous, rather dry, and slightly acid; the small intestine was filled with a yellow pulp, sufficiently fluid to flow easily. This pulp reddened turnsol paper, it became, by degrees, less liquid as it was further distant

from the point where the small intestine was united to the gizzard; the large intestine, only, contained a small quantity of a thick dark yellow substance, almost brown; the cœca were full of a green substance, thick and fetid, the ejections, very liquid and slightly acid, held in suspension the green substance of the cœca, in which we could scarcely detect uric acid. From the different organs just mentioned, we extracted—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum	3·78	1·70	0·045
,, gizzard	8·00	4·42	
,, small intestine	14·25	3·35	0·155
,, large intestine	0·37	0·15	
Ejections	—	4·94	0·140
		14·56	
Total fat, of a yellow colour, and extremely fusible			0·340
Normal fat, to deduct.....			0·17
Difference ..			0·17
The rice digested contained, fat			0·52
Difference ..			0·35

Thus there were 0 gr. ·35 of fat belonging to the aliment which had been appropriated by the duck in four-and-twenty hours, say rather more than one centigramme an hour.

Assimilation or Respiratory Combustion of the Aliment.—

	gr.
Taken, or ejected from the digestive apparatus	14·56
Intestinal matters and normal ejections	5·02
Substance recovered in the intestines, and ejections	9·54
Dry rice digested.....	112·32
Assimilated or consumed in four-and-twenty hours.....	102·28
Per hour	4·28

The composition of the rice deprived of moisture may be represented by—

	gr.
Starch or analogous substances ..	89·20
Albumen	8·68
Fatty matter	0·46
Ligneous or cellulose substances..	1·10
Mineral substances	0·56
	100·00

In the composition of the 4 grs. ·28 of aliment, assimilated per hour, there enters 3 grs. ·32 of starch, and 0 gr. ·37 of albumen, substances which, when added together, contained nearly 2 grammes of carbon. Let us now see whether these two grammes of carbon are sufficient for the requirements of respiration.

In a former paper I have shown that a duck weighing 1 kil. ·33, consumed daily in respiration 42 grs. of carbon. The ducks that were the subject of the present experiments, weighed, on an average, 1 kil. ·09; we may, therefore, suppose that they consumed daily 30 grammes of carbon—say 1 gr. ·25 per hour. Now, as 2 grammes of this combustible entered into the food, assimilated in the same space of time, we see that the ration of rice ingested would amply satisfy the wants of respiration, and we may look upon it as a very proper quantity. It is also confirmed by experiment; for, on another occasion, I well fed some ducks weighing 1 kil. ·33 with a smaller ration of rice. I repeated the experiment, of which I have just given the results, shortening its duration.

SIXTH EXPERIMENT.

Another Duck crammed with Rice.—At half-past seven in the morning we began to cram it with steeped rice; at four o'clock in the afternoon we gave it the remainder of the food. The duck was killed at ten o'clock at night. 100 grammes weight had been ingested; but as we found 12 grs. ·95 in the œsophagus, the digested rice was reduced to 87 grs. ·55, representing 75 grs. ·56 of a dry substance. We collected—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum and gizzard	18·83	9·76	0·065
,, the intestines..	23·63	5·41	0·280
,, the cœca (green alkaline matter) ..	—	0·27	
Excrements	—	2·00	0·085
		17·44	
Total fat.....			0·43
Normal fat.....			0·17
Difference			0·26
In the 87 grs. ·45 of rice ingested, fat.....			0·35
Difference			0·09

Assimilation or Combustion of the Food.—

	gr.
Extracted, or passed from the digestive organs	17·44
Intestinal matters and normal ejections.....	4·68
Matters found in the intestines and ejections	13·56
Dry rice digested.....	75·56
Assimilated or consumed in 15 hours	62·20
Per hour	4·15

These two results are of the same character; there was, very nearly, indeed, the same quantity of matters introduced into the organism, only the fat that was wanting in the sixth experiment, to complete that introduced with the food, was less considerable. It is, however, to be presumed that the absorption of the fatty matter was greater than that indicated by observation; it is not enough, in fact, to find rather less fat than the digested aliments contained, to conclude against its formation during digestion. A perfect equality would appear even to be a presumption in favour of the production of the fatty matter, for it is scarcely natural to suppose that any part of this matter was not absorbed during its passage through the intestinal canal. To appreciate the proportion in which the fat is removed from the food during its passage in the digestive apparatus, I undertook several experiments.

SEVENTH EXPERIMENT.

A Duck crammed with Cheese.—Cheese was obtained by curdling skimmed milk and strongly pressing it; it contained 0 gr. ·358 of dry substances, and 0 gr. ·074 of butter. Among the substances there was necessarily found sugar of milk, because we placed it in the press without having previously washed it.

From half-past nine in the morning to four in the afternoon, we gave a duck 120 grammes of pressed cheese, equal to 42 grs. ·96 of dry cheese. The animal was killed at nine in the evening; we collected in the œsophagus morcels of cheese which, after being dried completely, weighed 4 gr. ·93. The duodenum contained a thickish kind of pulp; the gizzard a liquid, acid, paste. At the origin of the small intestine, the substance met with had the same degree of fluidity and acidity, and of the same appearance as that which filled the gizzard; further on, the chyme assumed a green hue, still preserving its liquid and acid nature. In the large intestine, we met with a thick green paste, slightly acid and fetid. During the desiccation of the matter extracted from the intestines, particularly towards the end of the operation, a strongly marked smell of roast meat was developed. I always noticed this smell, even when drying the substance obtained from the intestines of fasting ducks. The excrements were very liquid, and charged with uric acid. We obtained—

	Wet. gr.	Dry. gr.	Fat. gr.
From the duodenum and gizzard	10·73	4·68	0·53
„ the intestines	15·25	3·25	0·87
„ excrements	—	5·00	0·14
		12·93	

Total fat	1·54
Normal fat	0·17
Difference	1·37
In the 38 grs. ·03 of dry cheese ingested, fat	7·8
Food in the aliment absorbed in eleven hours and a half	6·50
Per hour	0·57

Assimilation or Combustion of the Aliment.—Extracted, or passed from the digestive apparatus ..... 12·93
Intestinal matters, and normal ejections ..... 3·67

Matters found in the intestinal and normal ejections	9·26
Dry cheese digested	38·03
Assimilated or consumed in eleven hours and a half	28·77
Per hour	2·50

The 2grs. ·50 of alimentary matter could be decomposed, as we have proved, into 0gr. ·57 of fat, containing 0gr. ·46 of carbon, and into 1gr. ·93 of cheese, containing 1gr. ·04—1gr. ·5 of carbon, therefore, intervenes during nutrition. This amount is even a minimum, for the uric acid excreted contains, in an equal weight, less carbon than the cheese that took part in its production. In conclusion, 1gr. ·5 of carbon is, still, more than sufficient to support the respiratory combustion. I will also add that the assimilated fat does not convey carbon alone into the organisation, it, also, introduces hydrogen, which participates in the production of animal heat. Cheese is, in this way, seen to be very nutritious, and we all know its practical employment for assisting in the rapid development of muscle and fat in young animals.

We have just seen that there was an absorption of 0gr. ·57 of fat per hour, when that substance was united, in the proportion of a few hundredths, to a body so nitrogenated, and fit for nutrition as cheese. It would be interesting to ascertain the limit of this absorption, by giving, as food, a substance essentially formed of fat.

EIGHTH EXPERIMENT.

A Duck crammed with Pig's Fat.—The smoked fat employed in this experiment contained, when separated from the rind—

Fat	96·3 grs.
Cellular tissue	1·0
Sea salt	1·0
Moisture	1·7
	100·0

At eight in the morning we began to cram it. The duck received 50 grammes of fat, it was killed at eight in the evening, when we were certain that the crop was empty. The gizzard only contained a small quantity of a yellow and acid substance. The two intestines were filled with chyme, tolerably liquid in the small intestine, but thicker in the large one, of a pale gray, opaline, and slightly acid. The cœca were much distended with a green and extremely fetid liquid. The ejections had been very abundant, because the animal had drunk largely; they were acid, and covered with a layer of congealed fat. We extracted—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum and gizzard	0·40	0·10	0·67
,, intestines	16·89	3·09	
,, cœca	1·00	0·084	0·74
Ejections	—	38·47	36·87
		42·50	

Total fat	38·25
Normal fat	0·17
Difference	380 8
In smoked fat ingested there was, fat	48·15
Fat absorbed in twelve hours	10·07
Per hour	0·84

Assimilation or Combustion of the Aliment.—

	gr.
Extracted or passed from the digestive apparatus	42·50
Intestinal matters and normal ejections	3·85
Matters found in the intestines, and ejections	38·65
Dry smoked fat ingested	49·15
Assimilated or consumed in 12 hours	10·50
Per hour	0·88

0 gr. 84 had been absorbed in an hour; this is nearly the same quantity as had been assimilated in my former experiments, when I added 60 grammes of butter to 125 grammes of rice, which formed the ration of a duck, the fat fixed in a day rose to 19 or 20 grammes, say 0·81 per hour

In comparing the dry portions of the food with those extracted from the intestines, we see that fat alone has been absorbed. The smoked fat without lean is evidently an insufficient nourishment, not only because it does not contain a sufficient quantity of nitrogenated alimentary principles, but also because the fat which it furnishes to the organism, does not even contain the necessary quantity of combustible material required by respiration. The 0 gr. ·88 of pork fat assimilated in an hour containing, at the utmost, 0 gr. ·7 of carbon, when, at the same time, the animal consumes 1 gr. ·25.

We find in fact, that fat, when it is given alone, is not absorbed in a larger proportion than when it is mixed with food very rich in starch. I was obliged to ascertain whether it would be the same, in case the fatty matter should be united to a nitrogenated principle, as is the case in most oleaginous seeds, which possess in the highest degree the property of nourishing and fattening animals.

(To be continued.)

ON CAVENDISH'S EXPERIMENT RESPECTING REPRODUCTION OF NITRIC ACID.*

BY DR. DAUBENY.

Dr. Daubeny's experiments were instituted with the view of ascertaining whether the production of nitric acid by electricity, as was first effected by Cavendish, really arose from the direct union of oxygen with nitrogen, or was produced indirectly through the presence of minute portions of ammonia. For this purpose he deprived the air, through which the electrical sparks were to be passed, of water and of any traces of ammonia that might have been contained in it, by allowing it to stand in contact with concentrated sulphuric acid, for some time previous to the commencement of the experiment. Even in this case, although the air had been in contact with no liquid except the mercury, over which it was confined, the usual diminution of volume took place after the electrical sparks had been passed through it, and solution of litmus, when introduced into the tube, became sensibly reddened. Hence the author infers that nitrogen does combine directly with oxygen, as it is now known to do with carbon; but he still questions whether it can do so with gaseous hydrogen, since ammonia cannot be formed, as nitric acid is, by means of electricity, and as in all the cases in which ammonia has been produced artificially one of the elements appears to have existed in what is called a nascent state. But, if nitrogen can be made to combine directly with oxygen, how comes it that, through the operation of thunder-storms, the composition of the whole atmosphere has not before this time been changed by the production in it of considerable quantities of nitric acid? This the author explains by the small amount of heat generated by the union of the two gases;

* Read before the British Association of Science.

owing to which only those particles combine which lie contiguous to the line of the electrical spark; whereas, in other cases, as is that of the union of oxygen with hydrogen, so much heat is generated by the union of those particles which are affected by the passage of the electrical spark, that a condensation of other portions of the mixture results, whence will arise a union of more of the particles, and an extraction of a larger amount of heat. In this way the explosion propagates itself through all parts of the mixture with a rapidity which causes it to be considered by us as instantaneous. In all cases, however, in which gaseous elements that can remain together without acting upon each other are made to unite, the *modus operandi*, whether it be by electricity, heat, or (as in the case of porous bodies) by adhesive affinity, appears to be the same; that is, such a condensation of the respective gases as shall bring their particles within the sphere of mutual affinity.

OBSERVATIONS ON THE THEORY OF PROTEIN.*

BY GEO. KEMP, M.D.

The subject of protein is so important in its relations to animal and vegetable chemistry, that any analytical researches which have a tendency to render its nature more intelligible, or to correct any previous misapprehensions respecting it, must be considered as of paramount importance. The recent researches of M. Laskowski (published in the *Chemical Gazette*, No. xciii.) are calculated to convey an impression to the minds of those whose engagements may not permit them minutely to investigate the subject, that the very ground-work on which important conclusions have been conventionally received by all parties is unsound, and that the whole fabric of organic chemistry in its relations to physiology must be again surveyed and remodelled. With the full conviction that no apology is necessary for the introduction of even preliminary investigations on the subject, the writer begs attention to the following facts, at once to a great extent confirmatory of M. Laskowski's qualitative analyses; whilst, at the same time, tending to show that, with the full admission of their truth, the deductions of Prof. Mulder remain practically unaffected.

The problem to be solved is, does the protein of Mulder contain sulphur; and, if so, does it contain sufficient to affect conclusions resulting from the adoption of his formula, or indeed any other legitimate empirical expression for its composition? If we take perfectly fresh albumen, treat it with hydrochloric acid, and then into the filtered solution pass a current of chlorine gas, we obtain a copious white precipitate, which can be collected, and washed without difficulty (Berzélius, vol. ix. p. 813). This body is denominated chlorite of protein, from its being a compound of what Mulder denominates protein and chlorous acid. Now, it is assumed that this body, easily prepared and isolated, affords a legitimate subject upon which to found a decision, that if sulphur be contained in this body the same element must be admitted to exist in protein, and that the quantity contained in it will determine the quantity contained in protein.

In order to render the conditions of the analyses similar, the method used by Prof. Redtenbacher for the determination of the sulphur in taurine was adopted in this case; not however because the writer believes that method the best, as a much simpler and more effective one will be detailed in the sequel.

A mixture of nitrate of potash and carbonate of soda was prepared, perfectly free from sulphates. The substance to be analysed was prepared with the most scrupulous attention, and, when mixed with the oxidising agent, introduced into a combustion-tube and cautiously operated upon in the manner usual for organic analysis. The combustion completed, the whole contents were carefully dissolved in distilled water, pure acetic acid added in excess, the resulting solution precipitated with nitrate of barytes, and the sulphur estimated.

The following were the results:—

I. 552·5 milligrms. gave 63·0 milligrms. of sulphate of barytes.

II. 726·0 milligrms. gave 82·5 milligrms. of sulphate of barytes.

Or—

I. 11·4 per cent. of sulphate of barytes = 1·57 p. c. sulphur.

II. 11·3 per cent. of sulphate of barytes = 1·56 p. c. sulphur.

That sulphur then exists in the compound is decided; the quantity however is remarkable, being twice the amount obtained from albumen by Mulder.

Having now determined the quantity of sulphur, we proceed to examine its influence on the formula proposed by Mulder; and it is evident that the amount of carbon, hydrogen and nitrogen having been decided, whilst that of the oxygen has been merely calculated, it is this element alone which will be affected. Now, Mulder's formula is $C^{40}H^{31}N^{5}O^{13}$; but, in order to derange it even to the amount of a single equivalent of oxygen, we should have 3·6 per cent. of sulphur, that is, double the quantity which it contains,

* *Chemical Gazette*

supposing, which is now pretty well decided, that the whole of the sulphur in albumen is retained during the process of forming protein;* and thus the deductions which have been made for the purpose of explaining physiological phenomena remain uninjured, so far as it regards the influence of sulphur.

It is true that, by multiplying the results of the analysis by ten, a different expression is required; but then it must be remembered that the unavoidable errors of analysis are multiplied also. Mulder, indeed, made use of this artifice with reference to albumen and fibrin, to show in what he considered the specific distinction of these bodies consisted, and in what condition sulphur and phosphorus might be supposed to exist in them. The latter hypothesis, however, is no longer tenable, and it seems, from the recent researches in Liebig's laboratory, that sulphur, at least, is present in very variable proportions; so that albumen is either a compound of bodies, one of which contains sulphur as an essential part, or else the sulphur is present as a mere mechanical adjunct.

The following plan for determining the sulphur in organic compounds will be found more simple and convenient than most of the others proposed. Fine quartz sand is treated with hydrochloric acid and well washed; the liquid being tested, to ascertain the absence of sulphates. When dried at a high temperature a mixture is formed of one-third chlorate of potash, perfectly free from sulphates and phosphates, and two-thirds sand. The object of the sand is to prevent the too rapid oxidation of the organic body and the risk of a portion being thrown out of the crucible. The body to be examined is now intimately mixed with the above, introduced into a large platinum crucible, and exposed to a high temperature over a spirit-lamp. The process is completed in a few seconds. The contents of the crucible are now to be treated with boiling distilled water, the insoluble portion separated by filtration, and washed until no traces of sulphuric or phosphoric acid remain; and the sulphates and phosphates, which by this plan may be estimated simultaneously, determined by means of a salt of baryta.

* Mulder by no means assents to his protein containing sulphur, but firmly maintains the contrary.

ON THE EXISTENCE OF A NEW OXACID OF NITROGEN, AND ON THE THEORY OF THE MANUFACTURE OF SULPHURIC ACID*

BY M. CH. BARRESWILL.

The author endeavours to prove that the blue liquid obtained, by condensing, by means of cold, a mixture of liquid hyponitric acid, and binoxide of nitrogen, is neither nitrous acid nor a mixture of binoxide of nitrogen and hyponitric acid, but rather a definite compound, whose formula probably would be $N^2 O^7$ (N=175), corresponding with supermanganic and superchromic acids.

One of the most convincing proofs that the blue oxacid of nitrogen is not nitrous acid, is its reaction with concentrated sulphuric acid, which, instead of simply uniting with it, as takes place in the case of nitrous acid, is instantaneously decomposed, giving rise to a crystallised combination of sulphuric and nitrous acids, and at the same time, to a considerable disengagement of hyponitric acid.

This compound, to which the author, by analogy, gives the name of perazotous acid, has not as yet been capable of being combined with bases. Still, however, it has been proved that it contains a water of constitution, and also that it can be decomposed by water.

The memoir is followed by considerations on the manufacture of sulphuric acid. Three theories divide the opinions of chemists, that of Messrs. Clement and Désormes, that of M. Berzelius, and that of M. Peligot. The theory suggested by M. Barreswill differs from them all, or, more properly speaking, includes the whole of them. From the facts alluded to, and discussed by the author, we may establish the following propositions.

1. Binoxide of nitrogen and sulphurous acid, in contact with air, unite, to form the compound $SO^2 NO^3$, a combination of sulphuric and nitrous acid.

2. This compound, which is very unstable, is decomposed in water, according to the proportions of the vehicle, either into hyponitric acid and binoxide of nitrogen, or into nitric acid and binoxide of nitrogen, or finally into pernitrous acid and binoxide of nitrogen.

3. Hyponitric acid, with sulphurous acid, regenerate the compound, $SO^3 NO^3$, and, consequently, binoxide of nitrogen.

4. Nitric acid, with binoxide of nitrogen, forms pernitrous acid, which, with sulphurous acid, produces, finally, binoxide of nitrogen and sulphuric acid.

Thus the absorption of oxygen by sulphurous acid depends, not on a direct oxidation, but, on the one hand, on the successive for-

* *Comptes Rendus.*

mation and decomposition of the compound $SO^3 NO^3$, and on the other, on the reaction of binoxide of nitrogen on the air, and on the reaction of that gas with nitrous acid or nitric acid.

With the partizans of the first theory, M. Barreswill admits the existence of an unstable compound, only he does not consider it necessary that this compound should exist in a crystallised state; it also may exist in solution in sulphuric acid, which is introduced designedly into the manufacture, or remain, ephemerally, in suspension in the atmosphere of apartments. He acknowledges, along with M. Berzelius, the necessity of the formation of an extremely oxidising body, only he thinks that this compound is hyponitric acid, and cannot be nitric acid. Finally, with M. Peligot, he agrees that the formation of nitric acid is a necessary result; but he disputes the fact that this acid is attacked in a direct manner by sulphurous acid, and believes that it is only reduced because it has been previously decomposed by binoxide of nitrogen, with which it forms, either hyponitric acid or pernitrous acid, which are the sole oxidating substances.

ON THE FALLACIES CONNECTED WITH THE IODIC ACID TEST.*

Mr. Alfred S. Taylor, in a late number of the *Medical Gazette*, has made some experiments, and arrived at certain results, which, indicating a source of error in standard works on jurisprudence, require to be known. He states, that MM. Devergie and Tanfflieb, in testing the stomach of an individual poisoned by sulphuric acid, arrived at a series of conclusions, one of which was to the effect, that on resorting to distillation of the stomach and its contents, certain inconveniences would be avoided by collecting the liberated sulphurous acid, and passing it through iodic acid, which, being decomposed, became a new test for sulphuric acid. Mr. Taylor proceeds to say—

"M. Devergie refers to these experiments, and expressly states that the iodic acid, while it is a very delicate test, furnishes a certain proof that sulphuric acid must have existed in the matters submitted to analysis, either in a free state, or in combination with a metallic oxide.

"A case has recently occurred to me, in which the inapplicability of the iodic acid test, under the circumstances in which its use is advised by M. Devergie, will be apparent. Mr. Eastes, surgeon, of Folkstone, lately brought to me for examination, the stomach of a man who, it was suspected, had been poisoned by some companions with whom he had been drinking. The contents of the organ were of a dark colour, but the surface of the mucous membrane itself was not carbonised. No trace of sulphuric acid could be detected in the stomach or its contents, by the ordinary process of digestion in water and boiling. The dark grumous matter was found to be nothing more than altered blood, the man having suffered from an attack of hæmatemesis. An opinion was therefore given that the deceased had not died from the effects of sulphuric acid; and this was corroborated by other circumstances which transpired. Had the process advised by MM. Tauffieb and Devergie been employed, there is not the least doubt, from the facts about to be related, that sulphuretted hydrogen would have been obtained, and this, from its action on iodic acid, would have been considered to furnish evidence of the presence of sulphuric acid in the stomach.

"The string with which the stomach was tied appeared somewhat blackened, although quite firm, and free from any signs of corrosion. A portion was dried and heated in a tube to redness; the products of the distillation were received on paper, saturated with starch, and moistened with iodic acid; blue iodide of farina was immediately produced. A portion of clean string, similarly treated, had no effect on the iodic acid. The cause of the difference was undoubtedly owing to the blackened string being saturated with mucus and blood.

"A portion of pure gluten, which contains sulphur, was now employed, and blue iodide of farina was immediately formed. The same result was obtained by heating macaroni, a piece of flannel, dried albumen, dried blood, caoutchouc, and lastly, a portion of the dried human stomach itself, in a case in which it was certain that no sulphuric acid could have been taken, and the organ had been well washed. The fact is, all substances containing sulphur will yield products at a red heat, which easily deoxidise iodic acid; and I would suggest this as a good supplementary test for sulphur in organic matter, where the compound of oxide of lead in potash cannot be easily employed.

"It appears, from the results of the foregoing experiments, that when sulphuric acid cannot be detected in the contents of the stomach in a free state, the chemical investigation must be considered at an end. The medical witness who depends on the results of the dry distillation of the stomach or its contents, may be induced to give a most incorrect opinion.

* *Lancet.*

"I had recommended the employment of the iodic acid test, according to the method above described, for the purpose of detecting sulphuric acid in stains on clothing, accompanying the recommendation with the precaution, that an opinion of the presence of the acid could only be expressed when unstained portions of the cloth similarly treated gave negative results. In a recent examination of some stains on black cloth, I found that the iodic acid was easily decomposed, both by a stained and unstained portion of cloth. The result in the latter case most probably depended on the presence of sulphur in the woollen fabric. It has been already stated, that clean flannel, by dry distillation, easily decomposes iodic acid; but I found that neither linen nor cotton had any action on iodic acid, except when stained with sulphuric acid. Neither of these fabrics contains sulphur: hence, before employing the iodic test in these investigations, it would be proper to inquire whether the organic substance be one of those which are known to contain sulphur; if not, the test may be employed, otherwise it should be discarded. No risk can ever be incurred if the analyst only adopts the simple plan of experimenting on a portion of the unstained material in the first instance."

ON AN ADVANTAGEOUS MODE OF PREPARING CHROMIC ACID, AND ON A PECULIAR BEHAVIOUR OF THIS ACID TOWARDS SULPHURIC ACID.*

BY DR. P. A. BOLLEY.

THE process described by Fritzsche for preparing chromic acid from a hot solution of the bichromate of potash by means of sulphuric acid, is decidedly preferable to every other, on account of the large produce. Warington and Böttger have modified this process, because the product obtained according to Fritzche's method is not pure, but always contains some sulphate of potash; they recommend mixing a cold saturated solution of the bichromate of potash with 1 or 1½ part of monohydrated sulphuric acid.

The proportion of the sulphuric acid to the bichromate of potash is not stated by Fritzsche; the amount of acid prescribed by Warington and Böttger is so remarkably great and renders the product so dear, that it is worth while endeavouring to find a process requiring less sulphuric acid.

When 12 to 15 parts, by measure, of sulphuric acid are prescribed for 10 parts of the solution of the salt saturated at the ordinary temperature, this large amount has certainly some other part to act than the decomposition of the salt, viz., the precipitation of the eliminated chromic acid from its aqueous solution. I endeavoured to separate the two effects, and from the peculiar property which will subsequently be described, I adopted the following process as the best:—

A boiling saturated solution of the bichromate of potash is formed, and during ebullition a weighed quantity of sulphuric acid added to it sufficient to form, with the potash, a bisulphate. The mixture is allowed to cool, when it solidifies for the greater part to a granular red mass. This is not chromic acid, but sulphate of potash, with adherent chromic acid, together with which is formed a concentrated solution of chromic acid, which likewise contains some sulphate of potash. The mass is stirred with a rod to cause the granular part to subside, and the liquid portion decanted. The residuous mass is agitated with several small quantities of cold water, and what dissolves poured off. In this way there is at last contained in the dish an orange-coloured sulphate of potash with very little chromic acid. Most of the chromic acid is contained in the united solutions.

This process depends on the circumstance, that bisulphate of potash, which is very soluble at a boiling temperature (1 part in ½ water), is dissolved with difficulty at the ordinary temperature, and that cold water mostly removes from it sulphuric acid with scarcely any potash, leaving behind neutral sulphate of potash, while the chromic acid is extremely soluble in the cold water. The concentrated solution of the chromic acid, containing a little sulphate of potash and sulphuric acid, may now be somewhat evaporated, and the chromic acid precipitated from it by the addition of sulphuric acid, without any perceptible traces of the sulphate of potash being thrown down with it; for this salt is readily soluble in the monohydrated sulphuric acid, and still more readily in acid more diluted. The chromic acid is separated from the liquid by draining on a funnel, the neck of which is loosely stopped with fragments of glass, and then dried on porous tiles; by re-solution in water and slow evaporation, it may be obtained perfectly pure in large crystals. In volume there may have been used the same or 1½ time the amount of sulphuric acid, but the solution contains far more chromic acid than with Warington's process. The produce in chromic acid for the same quantity of sulphuric acid is consequently far greater, almost in proportion to the increase of solubi-

* *Liebig's Annalen*, and *Chem. Gaz.*

ility of the potash salt at the ordinary temperature and boiling-point; 1 part by weight of the salt requires at boiling-point nearly 1 part by weight of water, and the solution boils at 103°; at 18° it requires ten times the amount of water.

If, in this method, sulphuric acid is saved, the chromate of potash, on the contrary, is not wholly turned to account as in the other method; this does not render it less preferable in a pecuniary point of view, for all the residues, both the solid sulphate of potash which is mixed with chromic acid, as well as the acid liquid drained from the chromic acid, may be advantageously employed for the preparation of oxygen. It is only necessary to evaporate the acid somewhat previously, because when very dilute it does not decompose the chromic acid when heated with it. Böttger states that the residuary sulphuric acid may be used for purifying phosphorus from oxide of phosphorus, an application, however, which is of far less frequent occurrence than the preparation of oxygen.

All the methods above described for preparing chromic acid from its potash salt, readily lead us to believe that the chromic acid is insoluble in monohydrated sulphuric acid, because it is precipitated by it from its aqueous solution; such however is not the case. Sulphuric acid (SO^3, HO) dissolves considerable quantities of chromic acid at the ordinary temperature, becoming yellow, and finally quite dark brown and opaque. I soon cleared up this apparent contradiction, by adding a few drops of water to the solution of the chromic acid in the sulphuric acid; the chromic acid immediately separated. Since this proves that the chromic acid is precipitated from its *aqueous solution* by sulphuric acid, and from its *sulphatic solution* by water, therefore there must exist a proportion between the sulphuric acid and water in which chromic acid is not soluble; to find out this proportion, I made a series of experiments, the result of which was that the amount of water of the sulphuric acid came very near to the formula $SO^3\,2HO$. In fact, if we consider the solution of the chromic acid in monohydrated sulphuric acid as constituted according to the formula SO^3, HO $+ x CrO^3$, then CrO^3 is separated on the addition of 1 atom of water.

The author then proceeds to describe a combination of chromic acid with sulphuric acid, which is obtained when the former is gradually conveyed into the latter, and the mixture shaken for some time in a well stoppered bottle for the complete solution of the chromic acid. After some time no more chromic acid dissolves, and the dark brown fluid, at first of an oily consistence, acquires an ochreous colour and a pasty consistence, and even becomes sometimes granular. Its analysis is difficult, from the avidity with which it imbides moisture. From the results obtained, however, it would appear to be composed according to the formula SO^3 HO + CrO^3.

In conclusion, the author observes that the solution of chromic acid in monohydrated sulphuric acid is preferable as an oxidising agent to every other; its action on sugar or alcohol is so complete and quick, that the former, when not added in too large a quantity, may be entirely burnt into carbonic acid and water; while the alcohol, according to the quantity and degree of concentration, may be converted at pleasure either into aldehyde or acetic acid, a change which deserves mention as a very instructive class experiment, because the product of the reduction is immediately visible to the eye, and the product of oxidation readily detected by the organs of smell.

DETERMINATION OF THE SULPHUR IN THE NITROGENOUS CONSTITUENTS OF VEGETABLE AND ANIMAL BODIES.*

BY DR. E. RULING, DR. WALTHER, F. VERDEIL, AND A. SCHLIEPER.

LIEBIG'S *Journal* for July furnishes us with numerous determinations of the sulphur contained in various substances made by several chemists in the Giessen laboratory, the results of which are contained in the following table. The mode of determining the sulphur was by fusing the finely-pulverised substance in a spacious silver dish, with about twelve times its weight of caustic potash perfectly free from sulphuric acid, then mixing it with pure nitre in weight equal to about half the potash employed, and heating it until the fused mass appeared perfectly white. The whole was then dissolved in distilled water, supersaturated with hydrochloric acid, and the sulphuric acid precipitated by a salt of baryta.

Legumine.	Per-centage of sulphur.
From peas	0·505
From peas, having been previously dissolved in solution of ammonia	0·467
From beans	0·557
From beans,—having been previously dissolved in solution of ammonia	0·445

* *Chemical Gazette.*

	Per-centage of sulphur.
Vegetable Albumen.	
From peas	0·790
From potatoes	0·969
Gluten.	
From wheat-flour	1·134
From rye-flour*	0·989
Ditto*	0·972
Casein.	
From cow's milk	1·016
From cow's milk,—dissolved in a tolerably strong solution of carbonate of soda ‡	0·850
Ditto†	0·933
Ditto*	0·843
Albumen.	
From eggs	1·748
Ditto*	2·109
From the serum of a mixture of arterial and venous ox blood	1·386
From serum of arterial horse's blood	·303
From serum of venous horse's blood	1·285
Fibrin.	
From a mixture of arterial and venous ox blood	1·319
From ox blood*	1·593
Crystalline Lens.	
Mixture of that from oxen, calves and pigs	1·003
From oxen	1·121
From a calf	1·233
Albuminose.*	
Prepared according to Bouchardat's method	1·599
Ditto	1·441

	Per-centage of sulphur.
Isinglass.	
Washed with alcohol and ether*	0·727
Ditto*	0·647
Ditto‡	9·560
Crystalline.	
From a mixture of the crystalline lenses of oxen, calves and pigs	1·103
From oxen	1·227
*Pig's Bladder.**	
Purified by washing with water and alcohol	1·263
Ditto	1·354
*Cartillage.**	
Of a person who had committed suicide, ætat. 50	0·652

Those results to which an * is affixed were obtained by Dr. Verdeil, those with † by Dr. Walther, those with ‡ by A. Schlieper, and those without any mark were found by Dr. Rüling, who also determined the amount of carbon and hydrogen of the substances examined by burning with chromate of lead. As his results do not differ from those generally received, except in the case of legumine, which agreed better with those found by Dumas and Cahours than with those obtained by Mulder and Rochleder, we have not considered it necessary, with this exception, to give the numbers. Dr. Rüling found in 100 parts of legumine, dried at 212°—

					Mean.
Carbon	50·68	50·51	..	..	50·59
Hydrogen	6·74	6·93	..	..	6·83
Nitrogen	..	..	16·50	16·58	16·54
Oxygen	..	..	..	..	25 57
Sulphur	..	..	..	..	0·47

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

IMPROVEMENTS IN MAKING THE CYANIDES AND FERROCYANIDES OF POTASSIUM AND SODIUM.*

BY JAMES LAMING.

The patentee, before describing the invention as communicated to him from abroad, has, for the better understanding of the improvements, detailed the chemical facts or principles upon which they are founded; these are as follow:—

1st. When animal matter, which contains nitrogen as well as hydrogen and carbon, is exposed to a high temperature, not exceeding low red, an equivalent of nitrogen combines with three equivalents of hydrogen to form an equivalent of ammonia, and the carbon is separated.

2nd. When ammonia is exposed to carbon at a full red heat, an equivalent of ammonia exchanges two of its equivalents of hydrogen for two equivalents of carbon, and thus becomes prussic or hydrocyanic acid.

3rd. If free potassium or sodium be also present, the equivalent of ammonia parts with all its three equivalents of hydrogen and the nitrogen which remains takes in their place two equivalents of carbon to form

* *Newton's Journal.*

cyanogen, and one equivalent of potassium or sodium, as the case may be, to form a cyanide of the metallic base.

4th. When animal matter is exposed to heat, its temperature becomes gradually increased to low redness before it assumes that high temperature indicated by a full red colour; therefore, whenever animal matter is subjected to what is called destructive distillation, the formation of ammonia must take precedence, in point of time, to that of prussic acid or of the cyanides.

5th. When the oxide of potassium, or of sodium, or the carbonate of either of those oxides, is intimately mixed with carbon, and exposed to a heat approaching to whiteness, its metallic base is set free from the oxygen with which it was previously combined, and rises in vapour. If ammonia comes into contact with the mixture of carbon and alkali, or of carbon and alkaline carbonate, the separation of the metallic base from its oxygen takes place at a lower temperature—under such circumstances, a full red heat being sufficient. In the case of the carbonates, the metallic bases, potassium and sodium are liberated from the carbonic acid also, whenever they separate from their oxygen.

6th. Cyanide of potassium, or cyanide of sodium, by exchanging an equivalent of every three equivalents of its base for an equivalent of iron, is converted into the corresponding ferrocyanide, or what is called, in commerce, prussiate of potash, or prussiate of soda; and this change may be effected by causing the cyanides of the respective metals, dissolved in water, to come into contact with iron, or oxide of iron, in a state of division.

The ordinary way of combining potassium or sodium with cyanogen, preparatory to making the prussiate of potash, or prussiate of soda, for commerce, is to expose in iron pots an impure carbonate of one of those alkalies and animal matter to a red heat, and to trust for the necessary contact of the nitrogen and carbon of the animal matter with the metallic element, to the thorough incorporation of the ingredients of the pasty mass by stirring. While the temperature of the animal matter is approaching redness, ammonia is constantly being generated, and as it is volatile, it escapes and is lost; and this continues until the heat becomes great enough to convert the nitrogen and carbon of the animal matter into cyanogen, and to fix that cyanogen, by combining it with the metallic base of the alkali. Another source of loss is, the difficulty of causing the different elements contained in the pasty mass to combine; for, before each can be brought into contact with the other, by mechanical agitation, their temperature becomes elevated, and great part of the resulting nitrogenous gases, which are volatile, have time to escape. There is a third evil attending the ordinary process, namely, the proportion of carbon in animal matter, compared to its nitrogen, is greater than that in the alkaline cyanides; the greater part of this carbon, from its fixed nature, remains to solidify the mass from which the nitrogen so freely escapes; so that it becomes necessary to suspend the addition of the animal matter, on account of the mass being too solid for the chemical action to go on before enough of nitrogen has been combined to convert much of the alkali into prussiate.

Two patents have already been granted for methods of preventing the losses sustained in the ordinary way of making the prussiates of potash and soda. By one of these methods the ammonia which is liberated from a heated mixture of alkali and animal matter, is conducted first over the surface of fused alkali (the said alkali having no admixture of carbon) and afterwards into a vessel containing a solution of alkali. The other of these methods directs that the ammonia, which results from animal matter exposed to heat, be made to pass upwards and downwards through a series of vertical pipes, arranged on the principle of inverted syphons, heated to redness, and charged with a mixture of charcoal, potash, and iron, reduced to small fragments. With regard to the former of these methods, it is well known to chemists that fused alkali has no power of decomposing ammonia into cyanogen unless carbon be present; and with regard to the latter method, it is obvious that, as the materials, if brought into a state of fluidity or pastiness, must, of necessity, choke the passage of the pipes, the method demands that the mixture in the inverted syphons should be kept from losing its solid or granular state; and the continuance of that state is secured by the large proportion of infusible charcoal compared to the fusible potash, which the patentee prescribes, as fulfilling his intentions in a satisfactory manner.

Now, under the present invention, the patentee makes use of charcoal or other form of carbon, in powder, mixed with one of the alkalies, or its carbonate or other salt, capable, under the circumstances, of surrendering its metallic base to cyanogen. This mixture is constantly maintained in a fused state, so as to be fluid, or at least in a pasty condition, which is highly favourable for converting the metallic base of the alkali, or its salt, into a cyanide, and which takes place rapidly under such circumstances, when a current of ammonia gas is introduced to the fused mixture. The metallic base of potash, or soda, or of

their compounds respectively, as the case may be, is liberated by the agency of the heated carbon, assisted by the affinity of the metallic base for the cyanogen, which is at the same time formed by the combination of heated carbon with the nitrogen of the ammonia; cyanide of the metallic base is thus produced, and this product is constantly augmented in quantity (the current of ammonia being continued) until great part of the alkali, or other compound of its base, has become converted into cyanide. When an alkaline carbonate is used, powdered charcoal to the amount of more than 30 per cent. of its weight, may be added, without destroying the fluidity of the mixture if the temperature is raised to a full red. When the potash or soda is in a caustic state, a larger proportion of charcoal may be added; or, what is more advantageous, the mixture will remain fluid, although the heat be raised not so high. Whether the ammonia gas is passed through the mixture of carbon and fused alkali, or other compound of its metallic base (which is preferred), or over its surface, it is better to have more than one vessel charged with the heated materials, and so connected together by pipes, that the nitrogen of the ammonia, which escapes the chemical reaction in the first vessel, shall not pass through the whole series without combining. The apparatus thus acts on the principle of a series of Woolfe's bottles, and according to this invention all the vessels are made red-hot, except the last, into which water, or some liquid convenient for arresting the vapours of alkaline metal, is put; or otherwise the vapours might be lost. The first product, as in the common process for making prussiate, is a cyanide of the alkaline metal present, which may be dissolved out from the mass, technically called "metal," by boiling the latter in alcohol, of about 0·896 specific gravity, from which, filtered hot, it spontaneously separates, in great part, on cooling. To obtain the ferrocyanide, the metal is to be treated in the usual way, namely, its soluble parts dissolved in water, then treated with iron, the solution evaporated, and when sufficiently concentrated and clear, set aside to crystallise; and the rough product is afterwards purified by recrystallisation.

The patentee states, that he does not claim the invention of any process for dissolving out or obtaining either cyanide or ferrocyanide from the compound termed "metal;" nor does he claim the construction of apparatus wherewith the process or processes may be carried on: but he describes some arrangements which have been found to answer. One of these consists of three iron air-tight covered pots, communicating with one another in the manner of ordinary Woolfe's bottles: that is to say, the induction-pipe of the first pot reaches to near its bottom—its eduction-pipe reaches down the interior of the second pot to near its bottom, and the eduction-pipe of this second pot terminates in like manner in the third pot; while the eduction-pipe of the latter plunges beneath the surface of some water or other liquid, convenient for oxidising and arresting vapours of alkaline metal. Each of the pots has a man-hole in its cover, by means of which it may be charged and discharged, and a door by which it may be perfectly closed. Each covered pot is so set in a furnace as to be heated to a temperature great enough to keep its contents in a state of constant fusion. Its charge, when fused, should about half fill it. By the use of this apparatus, the ammonia which is forced into the first pot, by reason of its own elasticity under the pressure attending its assumption of the gaseous state, passes through the fluid mixture of fused alkali and carbon in that pot, being there decomposed into nitrogen or cyanogen, and, as cyanogen, combining with and saturating the alkaline metal present; after which, the ammonia or its nitrogen or uncombined cyanogen, which results from its action on the carbon still remaining in that pot, passes into the second pot, to convert the alkaline metal, there present, into a cyanide. In like manner the ammonia or its nitrogen, or the resulting cyanogen, may arrive in the third pot; then is the time for stopping the operation, in order that the two first pots may be emptied and re-charged. Owing to the volatility of the alkaline metals at high temperatures, the pipes of communication between the pots are apt to become obstructed; for this reason they are proposed to be made straight, and joined together at right angles, in such a manner that by removing a screw-plug from the end of each rectilinear piece, the passage through it may be cleared by passing into it a short rod of iron; in order that this process need not be often repeated, the diameter of the pipes should be as great as convenience admits of.

The patentee next describes a modification of the preceding apparatus, wherein no pressure is required to overcome the resistance opposed to the current of ammonia by the fluid mass into which the induction-pipes of the preceding apparatus are immersed. In this modification, all the induction-pipes stop short at the covers of the pots, except that of the open pot, which may be allowed, without much inconvenience, to dip below the surface of the water or other liquid intended to arrest the metallic vapours.

The ammonia gas, in this case, urged for-

ward by an inconsiderable amount of pressure, comes into contact with the surfaces of the fused ingredients in the several pots in succession, until it is either decomposed and its nitrogen absorbed, as in the preceding case, or escapes by the last eduction-pipe of the series; to prevent which, either the number of pots may be increased, or, what is better, each of the three should be furnished with agitators, moved by machinery or labour. When the latter arrangement is adopted, each pot should be furnished with a lofty conical cover, containing, at its apex, a stuffing-box, in which the axis of the agitator turns, and which is kept sufficiently cool by a stream of water running through a small cistern, which embraces the stuffing-box. With this apparatus, the fused ingredients may be either in a fluid, semi-fluid, or pasty condition.

The patentee claims the making of the cyanides and ferrocyanides of potassium and sodium; or, as they are called in commerce, prussiates of potash and soda, in any suitable apparatus, by passing ammonia (either pure or mixed with such other gases as do not prevent the desired result) over the surface, or through the mass (according as the induction-pipes may dip or not below the surface) of potash, or soda, or other compound of potassium or sodium (capable, under the circumstances, of setting free its metallic base) in a state of fusion by heat, and mixed with charcoal or other form of carbon in powder, and in such proportion as to be adequate to effect, without destroying by its bulk, the fluid, semi-fluid, or pasty condition of the resulting mass. And, further, he claims, for the process or processes of this invention, the sole use of ammonia, or mixture, or combination of ammonia with other gases or vapours, whatever be the source from which it is obtained; provided always that in such mixture or compound there be no substance present capable, by its nature, of preventing the desired result. He claims, for example, the application to this invention of ammonia or carbonate of ammonia, obtained from gas-water, from urine, from the liquor condensed in the distillation of bones or other animal matter, or from one or other of the salts of ammonia, or a solution of ammonia; and also the ammonia or carbonate of ammonia which is obtained directly, mixed with other gases, in the carbonisation of bones, and other animal matters, and in the chemical treatment of guano. Whatever be the source from whence the ammonia is obtained, it is desirable that it should be made as free from the vapour of water as possible before it is introduced to the fused materials; for this purpose the substances from which it is to be eliminated may be dried, or else the ammonia may be passed, in an elastic state, in contact with some substance known to chemists to be convenient for desiccating that gas.

Instead of obtaining the ammonia by a separate process, or from a distinct vessel, the inventor sometimes causes it to be given off from animal matter contained in the vessel or vessels in which the cyanide is formed. For this purpose it is better to use the potash or the soda in a caustic state, causing it, while in that condition, to dissolve the animal matter. The following is the mode of proceeding:—A caustic solution of alkali, in water or other convenient liquid, is first made boiling hot, and to it, while boiling, as much animal matter is added as it will readily dissolve; the solution is next evaporated to dryness, and the mass preserved in that state for use. When a portion of this mass is put into each of the heated vessels, except the last, of such a series as has been described, and the last heated vessel is charged with carbon, mixed with some convenient compound of an alkaline metal, as before stated, then the ammonia, which escapes from any one of the vessels in the series, will have to pass through one or more subsequent vessels, and thus tend to suffer decomposition; the resulting nitrogen being converted into cyanogan, and then being absorbed. This admits of the cheaper kinds of animal matter being used—such as the undried flesh and viscera of carrion, and old woollen flock and rags, which, by reason either of humidity or too great volume, cannot conveniently be mixed in their natural state with red-hot alkali. The patentee claims this modification of the process as part of the invention for which this patent has been granted. Sometimes the mass resulting from the desiccation of the solution of animal matter in caustic alkali is put into red-hot open pots; in this case, much ammonia is lost, but the improvement which is introduced by replacing the ordinary mechanical admixture by an intimate chemical combination, affords a greater product in prussiate than can be obtained from an equal quantity of animal matter treated in the ordinary way.

NEW SACCHARIMETRIC PROCESS.*

BY M. EUG. PELIUOT.

THE author communicated to the Society of Encouragement, in its sitting of the 15th April last, a process of assaying crystallised sugar as well as syrups, by means of lime.

* *Newton's London Journal.*

This process, which is applicable to sugar, in a solid or crystallised state, such as raw sugar, as well as to liquid sugar, whatever be its nature and origin, requires no other instruments or re-agents than those which are found in all manufactures, and no more skill than is necessary to make an alkalimetric assay. It is based upon the action, essentially different, which alkalis exercise over the two sorts of sugar, the ordinary cane or beet-root sugar, and the glucose, or sugar from starch, raisins, and fruits.

The ordinary sugar combines with alkalis, and forms, with the bases, or chief ingredients, compounds in defined proportions, from which the sugar may be extracted without having suffered the least alteration.

The glucose also combines with alkalies; but it produces compounds of so volatile a nature, that it is impossible to preserve them for more than a few moments. In fact, if a solution of glucose and potash be left to itself, at the ordinary temperature, the quantity of free potash contained in the liquor is observed to diminish every day, and eventually disappears entirely where the glucose is employed to excess. The glucose transforms itself, in effect, into one or more acids, which give to the liquor a brown colour, and form, with the potash, neutral salts.

The action slowly exercised by the alkalis over the glucose, at the ordinary temperature, develops itself instantaneously on the solution of these bodies being boiled; in a few minutes, the transformation of the glucose into these acids takes place in a complete manner.

The alkali used by M. Péligot, for his saccharimetrical assays, is lime. It is known that pure water dissolves only a thousandth part of its weight of lime, whilst saccharine water dissolves a considerable quantity, in proportion to the weight of sugar which it contains.

To make an assay of raw sugar, 10 grammes of this sugar are weighed and dissolved in 75 cubic centimetres of water; to this solution is added, by degress, 10 grammes of slack lime, sifted and prepared in a glass or porcelain mortar, and beaten for about eight or ten minutes; then the mixture is passed through a filter to separate the undissolved lime, the chief ingredient having been employed to excess.

It is advisable to pass the liquor a second time through the filter, in order to be able to dissolve the whole of the lime which combines with the sugar. Then take, with a graduated measure, 10 cubic centimetres of the solution of saccharate of lime, diluted with from 8 to 10 decilitres of water; then pour into this liquor a few drops of blue litmus, and saturate it with a solution of sulphuric acid. A quart of this proof liquor contains 21 grammes of sulphuric acid to 1 equivalent of water. A quart of this liquor will saturate the quantity of lime dissolved by 50 grammes of sugar.

The first solution of sulphuric acid is introduced into the alkalimetric assay vessel, or into a vessel graduated to cubic centimetres, each of which is divided into 10 parts. This vessel being filled up to zero, the acid liquor is poured into the alkaline solution, which is kept in agitation until the blue tint of the latter turns to red, under the influence of the last drops of the proof liquor.

By observing, on the divisions of the vessel, the quantity of pure acid which it was necessary to employ to attain this point of saturation, the quantity of lime and likewise of sugar contained in the solution of saccharate of lime is given: the total contents of this solution is also known, by means of M. Payen's table for estimating the volume produced by specific weights of sugar and water.

For the ordinary raw sugars, destined for refining, the assay stops here; but it often happens that it is adulterated with *glucose*. In order to detect this fraud, and likewise to analyse the molasses and the sugars of inferior quality, proceed at first in the manner indicated for raw sugars.

After the first alkalimetric assay, introduce into a medicine phial a portion of the alkaline liquid, heated to 212° Far., in a vessel of hot water, for several minutes. If this liquor contains only the saccharate of lime, produced by the ordinary sugar, it becomes troubled by the action of the heat, owing to the property possessed by this calcareous compound, of coagulating when heated to 212° Far.; but this agitation ceases by the cooling of the liquor, which does not assume a deeper tint than before it was heated. In submitting it to a second alkalimetric process, after it has cooled, it returns to its primitive state.

But if the saccharine produce contains glucose, the solution heated by the hot water assumes a brown tint, and it leaves a brown deposit, which does not disappear after its cooling. If the glucose is in large quantity, it throws out a decided smell of burnt sugar. Lastly, the second alkalimetric assay gives a less quantity of lime than the first; this quantity appertains entirely to the ordinary sugar, the lime dissolved cold having produced neutral salts, on which the pure liquor of sulphuric acid has no action.

When heating pure glucose, the first alkalimetric assay, after the lime has been ground with the liquid in a cold state, would produce nearly the same alkaline proportions

as ordinary sugar; the second assay, made with a portion of the liquor, heated to 212° Far., would produce the same quantity of lime as that which was dissolved by an equal volume of pure water. This quantity is very small, and will saturate 4 cubic centimetres of the pure solution of sulphuric acid per decilitre.

Although the liquor assumes a brown tint, the point of saturation may be easily determined by adding thereto a little more litmus, and stopping, immediately the solution, which has become of a greenish tint, assumes a clearer hue by the addition of sulphuric acid.

The assaying of saccharine liquids is carried on in the above manner; it is only necessary to have the precaution to operate on liquors marking 6 or 8 degrees on the areometer of Beaumé.

The juice of beet-root and sugar possesses these properties. The quantity of slack lime employed in these liquids should be almost equivalent to the presumed quantity of sugar in the produce to be assayed: this quantity is shown approximatively by the areometric degree of the liquor.

NEW PROCESS OF REFINING AND PURIFYING ANIMAL AND VEGETABLE OILS AND GREASE.*

BY PETER BANCROFT.

THE nature of this invention consists in a process or processes of refining or purifying certain vegetable and animal oils, whereby they are better suited for lubricating the working parts of machinery; also in a process of refining or purifying tallow, to improve its lubricating quality; and likewise in a process of purifying and sweetening inferior descriptions of lard, and rendering them fit for human food, and applicable to all purposes for which the best Irish lard is now used. The vegetable oils which the patentee proposes to refine for the above purpose are, the common olive oils, Galipoli, Spanish, Portugal, Sicily, and such like qualities of olive oils. It is well known that these oils, when applied in their impure state to the working parts of machinery, quickly become glutinous, act injuriously upon the brass-work, and impede the proper working of the machine. This effect is produced by the action of the air upon the impurities contained in the oil, when the oil is exposed in small quantities. To remove this hurtful matter, the oil, when heated to about 90°, or thereabouts, is treated with a strong solution of potash or soda, either in the state of a carbonate, or made caustic by lime. The use of the alkali, in a caustic state, is generally preferred, in consequence of its producing less effervescence in the oil, and the operation being more quickly finished than when the carbonates of either of the above alkalies are made use of. The specific gravity of the alkali solution may be 1·2, or even stronger. During the time that the alkali is being added, the oil is to be kept in a constant state of agitation to cause a thorough mixing. In order to ascertain when the operation is completed, and a sufficiency of the solution is added, the following test may be used:—Put a small portion into a glass bottle, or any other convenient vessel, and add to it a solution of the alkali in excess. Shake it well, and then allow it to remain at rest for a quarter of an hour, or until the alkali has settled to the bottom of the vessel. Should the alkali settle quite clear, without causing a thick deposit to take place, the oil is sufficiently refined; if it does not remain clear, but carries down with it a thick soapy matter, more alkali is added to the oil under operation, until, on further trial, this effect takes place. The quantity of alkali required will depend entirely upon the quality of the olive oil operated upon. In practice it will be found that some qualities require as much as 8 per cent. of solution of specific gravity 1·2, while other qualities do not require more than 3½ per cent. When the above operation is completed, the oil is allowed to remain at rest for twenty-four hours, or until such time as the thick soapy matter, formed in the oil by the alkali, has subsided; the supernatant oil may then be run off and passed through a filter. It is stated, that oil thus operated upon will not tarnish the most delicate brass work, nor will it become thick and glutinous upon exposure to the air. The animal oil which the patentee prepares for lubricating purposes is the oil expressed from lard; and the process of refining this oil is exactly similar in all its details to that described above.

Before explaining his mode of purifying tallow, so as to make it fit for lubricating, the patentee remarks that all tallows are not applicable, those suited to the purpose being such as are termed in commerce Y.C., of light yellow colour, and sweet or good home-rendered tallow. Tallow of such description is melted by steam or other heat, and when the tallow has become fluid, but before it has become much heated beyond its melting point, a strong solution of potash, or soda, either caustic, or in the state of a carbonate, and of specific gravity 1·2, or thereabouts, is added; the tallow being kept in constant agitation during the introduction of the alkali.

* *Newton's Journal.*

Upon the first introduction of the alkali solution a very thick soapy matter is precipitated; the operation is completed when, upon a further addition of the alkali, this effect ceases to be produced; the tallow is then heated to about 180° or 200° of temperature, after which it is allowed to rest for twenty-four hours or more, according to the quantity operated upon and the heat of the weather. When it is perceived that the tallow in cooling is becoming slightly opaque, it is run off into casks, and while cooling must be well stirred to prevent it from granulating.

The process of refining and sweetening American and inferior lards is as follows:—In using American lard, it is, in most cases, too soft and oily; it is, therefore, advisable first to extract a portion of the oil by pressure; the lard is then melted by steam or other heat, and a strong solution of potash or soda, or carbonate of these alkalies, is added, as before, with constant agitation of the lard. It should be observed, that a weak solution of the alkalies is to be avoided, and that the stronger or denser they are made, the more perfectly will they separate the impurities from the oils and fats. The matter which is precipitated in the refining of the above oils and fats may be used in the manufacture of soap; the nature of the soap depending upon the alkali made use of. If it is required, an inferior oil or fat may be recovered from the deposit formed by neutralising the alkali by an acid. For this purpose the sulphuric acid, diluted with water, may be employed.

The patentee states that he is aware of the alkalies, potash and soda, having been used and recommended for the purification of oils and fats, but to the best of his belief they have never been employed for the purification of the oils and fats mentioned above, when those oils are refined for the purpose of being applied as described. He therefore claims the refining and purifying of olive oils, lard oil, tallow, and lard, for the purposes already mentioned, by treating them as herein described.

IMPROVEMENTS IN THE MODE OF PRESERVING ANIMAL AND VEGETABLE SUBSTANCES.*

BY ROBERT WARINGTON.

The first part of this invention consists in preserving animal and vegetable substances by coating them with common glue, gelatine, or concentrated meat gravy, or otherwise, so as to form an air-tight skin or covering over them.

A quantity of glue, gelatine, or concentrated meat gravy, is heated in a suitable vessel, and then the meat or other substance to be preserved, having been suspended from a string, is dipped into it; and when the coating of glue, gelatine, or gravy has solidified, the meat is again dipped; and this is repeated until a hard film or skin, of the desired thickness, has been obtained. Or the substance to be preserved is dipped into a mixture of plaster of Paris and water, and, when the coating has become hard, it is saturated with melted suet, stearine, wax, or other matter that will render it impervious to air. Or the patentee wraps round the substance to be preserved a thin strip or band of caoutchouc, gutta-percha, or any air-tight membrane, such a waterproof cloth, making each turn lap a little over the other; and when caoutchouc or gutta-percha is used, the edges of the band are cemented together by immersion in boiling water; or the edges of the band may be connected by a cement of caoutchouc or gutta-percha (dissolved in spirits of turpentine, bisulphuret of carbon, or other solvent), or any other suitable cement. Or the patentee covers the surface of the substance to be preserved, either before or after the operation last described, with a varnish or cement of caoutchouc or gutta-percha, or other suitable varnish or cement.

The second part of this invention consists in keeping the articles so coated, or any other animal or vegetable substances, immersed in glycerine, treacle, elaine, oils, and other like matters, not liable to such oxidation, decomposition, or other change from exposure to the atmosphere as would prevent the preservation of the animal or vegetable substances; these matters being kept in tight, but it may be open, vessels; and the animal or vegetable substances are only disturbed when removed for use.

Meats for the table should be half cooked, by boiling or roasting, previous to coating or submersion. When oils are used, the patentee prefers that they should be heated to 220° F., the articles are then immersed, and the oil is allowed to cool. Fats, oils, and waxy substances, which present a solid appearance at the ordinary temperatures of the atmosphere, should of course be melted previous to the immersion of the articles therein.

The patentee claims: Firstly,—the coating of animal and vegetable substances, as above described, for the purposes of preservation. Secondly,—the immersion and keeping submerged of such coated or other animal and vegetable substances in glycerine, treacle, elaines, oils, and other like matters which are

* *Newton's Journal.*

not liable to such oxidation, decomposition, or other change from exposure to the atmosphere as would prevent the preservation of the substances to be preserved: these matters aforesaid being kept in tight, but it may be open, vessels, and the substances aforesaid only disturbed when removed for use.

ON THE INFLUENCE OF PROTOXIDE OF NITROGEN UPON VEGETATION.*

BY M. VOGEL, JUN.

It is generally admitted that nitrous oxide is not capable of sustaining life, although a candle blown out is relighted, and burns with more brilliancy in this gas than in atmospheric air. The rapid combustion of the candle is owing to the easy decomposition of this gas at a high temperature—a decomposition which cannot be effected by the lungs in respiration; while air, which is but a simple mixture of oxygen and nitrogen, readily parts with its oxygen in the act of respiration. I have made some experiments to ascertain the influence of the protoxide of nitrogen on vegetation. The gas which I employed was obtained by heating perfectly pure nitrate of ammonia. I placed some seeds of cress, scattered over a moistened sponge, in a white glass flask, filled with protoxide of nitrogen. The seeds were introduced into the flask under water, and all atmospheric air removed as much as possible from the pores of the sponge by gently pressing it. A sufficient quantity of water was left in the flask to produce germination; the vessel was then closed hermetically.

For the sake of comparison, I placed in a flask filled with air another sponge covered with seeds of cress. In the course of a few days the seeds in the last vessel were developed, and began to form leaves. The case was different with the seeds in the protoxide of nitrogen; there not the least trace of the development of the germ could be observed; nevertheless the seeds had swollen, and were covered with a mucous layer, without having experienced any other change which could lead to the supposition of their having germinated. After two weeks I removed the sponge with the seeds from the flask; but as soon as they were exposed to the air they began immediately to germinate, proving that during their stay in the protoxide of nitrogen they had not lost the power of germinating, while they do not germinate when they have been in contact for some time with several other gases.

The gas in which the seed had been kept for two weeks had experienced no alteration; it did not contain the least trace of carbonic acid, and still set light to the glowing wick of a candle.

To ascertain the influence of this gas on plants already developed, I introduced into a flask filled with protoxide of nitrogen a sponge covered with plants of cress perfectly formed, observing the precautions mentioned above; for two days the young plants continued unaltered, but on the third they acquired a yellow colour, and towards the end of the week they drooped. Exposed to the air, they re-assumed in a few days their verdure and erect position.

It must be remarked, that the above experiments were made not only upon seed, but also upon the plants, and that the oxide of nitrogen was exposed to the direct rays of the sun, and kept in the shade, but that in neither case decomposition of the gas was effected.

* *Journal de Pharmacie*, and *Chemical Gazette.*

IMPROVEMENTS IN DISTILLING FROM INDIAN CORN AND OTHER GRAIN.*

BY HENRY MANDEVILLE MEAD.

This invention consists in distilling Indian corn, combined with rye or other grain, by preparing a wash as hereafter described, and then (instead of drawing off the wash from the grain) submitting the wash with the grain to distillation.

Rye is preferred to be used with the Indian corn, and part of the rye is to be in the state of malt. The wash is prepared in the following manner:—The Indian corn, rye, and rye-malt are reduced, by grinding, to a powder resembling coarse oatmeal; then, supposing the mash-tub to be 12 feet in diameter at bottom and 3 feet deep, with a rake revolving at the rate of 16 revolutions in a minute, water, at 160° Fahr., is run in to the depth of about 5 feet (qy. inches), and 34 bushels of Indian corn meal are introduced slowly, so as not to clog the rake. When the meal is well mixed with the water, as much boiling water is added as will increase the depth of the mixture to 16 inches, and the temperature will be thereby raised to from 175° to 180°; the rake is then stopped, and the whole permitted to stand for three-quarters of an hour; after which, the rake is put in motion again, and the

* *Newton's Journal.*

mash stirred until the temperature falls to 148°; then 9 bushels of rye-meal and 2 bushels rye-malt are added, the whole well stirred, and the rake thrown out of gear for half an hour; at the expiration of which period, the rake is again thrown into gear, and the stirring continued until the mash comes to 116°. The mash is then removed to a fermenting cistern, and the temperature reduced to 80°, by the addition of cold water; the mash being at the same time well stirred.

During the mashing process, a daily yeast is to be prepared, by mashing 24 lbs. of rye-malt and 200 lbs. of rye-meal in 40 gallons of water at 175°, and, after the introduction of 16 gallons of boiling water, allowing the mixture to stand for half an hour; the mixture is then stirred until it falls to 110°, cold water is added to reduce it to 98°, and it is set with what is called stock yeast, which will lower the temperature to 94°, and the whole is well stirred. This yeast, in a high state of fermentation, is run into the fermenting cistern, immediately after the mash has been introduced therein.

The stock yeast is to be prepared the day previous, so as to have settled down by the time it is wanted for daily yeast; it is prepared by mashing 45 lbs. of rye-flour and 10 lbs. of rye-malt in 12 gallons of hop water, at 160°, beating the mixture well, covering it over, and allowing it to stand for half an hour; when this time has expired, 4 gallons of hopwater at 175° are added, and thoroughly stirred in; then 12 gallons of boiling water are introduced, and the mixture is covered up, and allowed to stand for an hour; after this the mixture is stirred occasionally until the temperature descends to 116°, it is thinned with cold water, and from 5 to 6 gallons of stock yeast, made as described, are added; but, at starting, bakers' or brewers' yeast is used

The fermenting cistern in 9 feet in diameter at bottom and 6 feet deep, and the depth of the mash will be about 5½ feet; the cistern being open above, the fermentation proceeds very rapidly, commencing about four hours after the yeast has been added, and terminating in forty-two hours, when the mash will be ready to be run into the still, which is furnished with steam-pipes or apparatus for applying the heat of steam, instead of the direct heat of a fire, and the distillation is to be conducted in other respects the same as when distilling spirits in the ordinary manner.

The patentee claims the mode of distilling by employing Indian corn with other grain, as above described.

EXPERIMENTAL RESEARCHES ON THE FOOD OF ANIMALS AND THE FATTENING OF CATTLE, WITH REMARKS ON THE FOOD OF MAN.

BY R. D. THOMSON, M.D.

THE following observations are extracted from a small but valuable work, bearing the above title:—

"In the human species a morsel of food is grasped by the front teeth of both jaws, which are each supplied with sixteen teeth, making thirty-two in all. In those animals which chew the cud, as they have only one row of teeth, the food is less firmly grasped by the jaws, and there is, therefore, a greater necessity that it should be of a soft and pliable nature. By the assistance of the lips, jaws, tongue, and auxiliary muscles, the food is conveyed into the cavity of the mouth, and by the aid of the tongue and lateral motion of the mouth it is placed between the opposing jaws, where it is masticated or ground to a proper consistence. But the action of the jaws in grinding the morsel introduced between them, at the same time elicits the compressing power of the muscles of the cheek upon the parotid gland, which is situated in man in front of the ear, and expels its secreted fluid, the saliva, into the mouth, to assist in comminuting the nutritive matter. Besides this mechanical action, there is, however, a nervous sympathy called into operation. The masticated matter acts upon the tongue and adjacent parts, inducing a sympathy with the glands placed under the tongue, and causes them to pour out their copious contents. The object of mastification or chewing is, therefore, to reduce the food to such a consistence as shall fit it for its reception and proper digestion in the stomach. This is well illustrated in the instance of animals which are not supplied with teeth.

"The common fowl, for example, is destitute of these grinding apparatus, but it has a muscular mechanism termed the gizzard, which powerfully compresses the introduced food, and by means of pebbles and stones, which are a necessary article of food with the class of animals referred to, an artificial substitute for the teeth is provided. In graminivorous animals, we shall presently find that a substitute for the second row of teeth is provided in the operation of rumination, or chewing the cud. From attention to these facts, therefore, we are taught that the preparatory step of digestion consists in the fine division of solid food by means of the apparatus set apart in the mouth for this purpose,

and its mixture with a certain amount of fluid saliva to render it more dilute.

"The importance of the proper grinding of the food, and of rendering it as soluble as possible, can be well appreciated by such individuals as have been the subjects of indigestion, from the eructation of morsels of food, of gases, and of acid liquors. It is scarcely necessary to remark, that similar rules are applicable to the inferior animals, and more particularly in the state of confinement to which most of them are more or less subjected when they are made to minister to the wants of the human species. The following comparative table exhibits this fact in a sufficiently striking manner. Two cows were fed on entire barley and malt, steeped in hot water; they were then fed on crushed barley and malt, prepared in the same manner. The influence of the finer division of the grain in augmenting the product of milk places the importance of this position beyond all cavil:—

	Brown Cow. Milk in periods of 5 days. lbs.	White Cow. Milk in periods of 5 days. lbs.
Entire barley and grass.....	111¼	106
	97½	94
Entire malt and grass.....	96	98
	95	104
Crushed barley, grass, and hay..	115½	109½
	105	109½
	110	110
Crushed malt and hay	97	106½
	96	107½
	98	111½

"An inspection of this table shows, that with the entire barley the milk diminished during the second five days of the experiment, while with the crushed barley the milk had a tendency to increase during each succeeding period. In all such experiments there are continually occurring irregularities, of which we have no means of precisely appreciating the causes. These proceed often from atmospherical influences, as temperature, and frequently from the condition of the animal. We are, therefore, taking a legitimate view of an experiment, when we direct our views to the tendency to improvement or deterioration in the course of the trial, rather than to the actual numbers obtained. In the preceding table, the tendency to an increase of product is decidedly in favour of the finely-divided grain. There are some anomalies, more particularly with reference to the brown cow, which was rather a fiery animal, and probably placed in peculiar physical conditions, as will subsequently be explained.

"The nature of the saliva, which is a fluid of the simplest constitution, as it contains 99½ per cent. of water, directs our attention to the nature of the fluid to be used in quenching thirst. It has become customary in towns to stimulate the systems of cattle, more especially of cows, after the fashion of human beings, by the use of alcoholic fluids, such as ale, under idea of increasing the amount of milk. Now as the stimulating portion of this ale is alcohol, and contains no curd, or if so, but an insignificant portion, it is evident that no increase of the nutritive constituents of the milk is thereby obtained."

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SUBSTITUTES FOR POULTICES AND FOMENTATION CLOTHS.

We have received specimens of a newly manufactured article intended for the above purpose, and there appears, from what we have seen of their effects, that there can be little doubt of their ultimately entirely supplanting the old fashioned and disgusting poultice. Mr. Markwick, the surgeon to the Western German Dispensary, has made a series of remarks on this subject, a portion of which we lay before our readers:—

"There is no therapeutic agent that has been more commonly resorted to in the treatment of disease, both by the medical practitioner and the public in general, than the common bread-and-water and linseed-meal poultices—a proof, if any were required, of the great repute in which they have been held; a fact, too, that is fully exemplified in the writings of Abernethy, in which he speaks very highly in their favour, and enters minutely into the process of making them. In describing the linseed-meal, or what he terms the 'greasy poultice,' he says, 'It is beautifully smooth; it is delightfully soft; it is warm and comfortable to the feelings of the patient, and is the best application that can be made to an in-

flamed part,' 'provided,' as he says in another place, 'the linseed-meal with which it is made is sufficiently fine; but I never see any such thing now as good, fine linseed-meal; it is all pressed into oil-cake and given to cattle to fatten them.' Still, however beneficial they may have been, they have not, unfortunately, been free from objections; and from the last paragraph above quoted, we may infer, and very justly, that even Abernethy himself had frequently cause to complain. Since his time, great progress has been made in both medicine and surgery, and medical men have been led, in consequence of these objections, to abandon, in a great measure, the use of poultices, and to have recourse to other means of applying warmth and moisture, with a view to produce equally good effects, unattended by disadvantages. It is doubtful, however, whether the requisite beneficial results such as can be obtained by the proper application of moist heat, have been produced by the materials that have been hitherto substituted for them.

"Poultices are external applications, or epithems, of a pulpy and tenacious consistence, possessing emollient, sedative, stimulating, tonic, astringent, or antiseptic properties, according to the nature of the ingredients of which they are made. They may be said to consist of two parts—the liquor, or fluid part, and the corpus, or that upon which their consistence depends. A third, the accessorium, which is not always present, was added by the ancient pharmaceutists. The corpus, or body of the poultice, is generally formed of bread, linseed-meal, potato-starch, bran, or malt, and is intended merely as a recipient for the liquor and the accessorium, upon which alone the effects of cataplasms depend. The liquor consists of simple water, or some mucilaginous decoction, and any addition made to it, with a view of converting the common emollient poultice, which I take as the type, into one of a sedative, stimulating, tonic, astringent, or antiseptic character, is to be considered as an accessorium.

"The great objections that have been raised against the ordinary poultices are, that they do not retain their warmth for a sufficient length of time; that they soon become dry and harsh, and require frequent changing; that the material or substance which is usually employed to give them the requisite consistence, is of that nature as not only to enter quickly into decomposition, and in this state to evolve a very fœtid disagreeable odour, and likewise to irritate the skin, and even in some cases to occasion a pustular eruption, but also to form with the water a heavy compound, perfectly insupportable in many very painful affections. This is more particularly the case with linseed-meal, which has the property of combining with the fluid, and thus preventing its proper, necessary, and effectual contact with the skin. In a word, as has been well remarked by Mr. Liston, in his 'Operative Surgery,' p. 33—'Weight, putrefactive fermentation, stench, and filth, are inseparable from the best and most scientific contrived epithems and cataplasms.' In fact, it is owing to these very great disadvantages, which constantly attend their application, and the impossibility of effectually producing all the beneficial effects of warmth and moisture by their means, that they are daily falling more generally into disuse; indeed, they have long since been abandoned by some of our first surgeons; and Mr. Liston remarks (*loc. cit.*, p. 231), when alluding to this subject, that 'a poultice—the very name of which is associated with putrefaction and nastiness—has very seldom been employed either in my hospital or private practice for the last ten or twelve years; in fact, our nurses at the North London have now almost forgotten the mode of forming the abomination.' Under these circumstances, therefore, it became necessary to discover some material, by which heat and moisture might be so effectually applied as to secure the whole of their beneficial effects, without any attendant inconvenience or bad result. This has lately been most successfully accomplished by the newly-invented article I am about to introduce, and to which the attention of the profession is earnestly requested. And I do so with a full conviction, from the numerous trials that have been made of it, both by myself and other professional men, that it will be found to be admirably adapted for the purposes for which it is intended.

"A poultice should be a light, clean, and comfortable application, free from any unpleasant smell or tendency to decomposition. It ought also to be easily and quickly made, capable of holding a large quantity of fluid, and a bad conductor of heat, in order that it may not cool too rapidly, and require to be too frequently renewed; while its corpus, or body, should act merely as a receptacle for the liquid, so that this latter may come into direct contact with the part to which the epithem is applied.

"Such, then, being the necessary requisites for materials intended to convey heat and moisture, let us see whether they are possessed by the one I am now recommending.

"This is an article composed of a mixture of sponge and wool, felted together so as to

form an even and soft fabric, which may be made of various degrees of thickness, and afterwards rendered impermeable by a coating of India-rubber. Hence I propose to term it, the 'Impermeable Spongio-Piline.' Its texture, therefore, is spongy, and it is thereby enabled, in the first place, to hold a considerable quantity of fluid, which it readily yields to the part to which it is applied, and in the second, renders it a bad conductor of heat; consequently, from this, and from the evaporation being at the same time prevented, by its caoutchouc backing, it retains its warmth and moisture for a much longer time, and produces much more beneficial results, than any other substance, even when covered with oiled silk, inasmuch as this, although perfectly impervious when new, and good, allows the vapour to escape between it and the material over which it is placed.

"This watery vapour, therefore, being effectually prevented from passing off by the India-rubber, tends to keep up the temperature of the epithem, and to greatly promote, for a considerable period, and without the necessity for frequent renewal, its soothing and relaxing action. How different, in this respect, from the ordinary poultice, which, I maintain, requires to be renewed at least every hour, and in many cases oftener, to ensure the requisite and beneficial effects of its warmth and moisture; for it is well known that, after that time, sometimes long before, there is no longer any warmth in the epithem. This, however, is but very seldom, if ever, done; on the contrary, it is allowed to remain for as many as four, six, eight, or ten hours, and even longer, during nearly the whole of which time it is not only useless, but in many instances decidedly injurious.

"There is one circumstance connected with the common poultice, which is, that the greater the heat of the part the more frequently does it require to be changed, for the caloric which, under these circumstances, is disengaged, very speedily dries up its moisture, and greatly accelerates the putrefactive fermentation or decomposition. Now, to neglect this, or to pay the strictest attention to it, would alike be a source of considerable annoyance to the patient. Let us suppose, for instance, a person to give his or her careful and unremitting attention to the hourly repetition of the poultice, with a view to procure the utmost benefit from its warmth and moisture; can it be denied that this is extremely irksome, and indeed, as every medical man must have observed, painful to the sufferer? On the contrary, suppose the person is not so attentive, and, instead of changing the cataplasm, allows it to remain, as we have before mentioned, for several hours, what then is the result? Why, it becomes dry, adheres to the part, and undergoes decomposition, very fœtid disagreeable gases being evolved, which are so irritating as frequently to produce a pustular eruption, and aggravate the affection for which it was applied.

"Hence, then, a poultice can never constitute a proper and effectual means of applying warmth and moisture; whereas, the new material is perfectly free from this very important objection, inasmuch as if allowed to remain for twenty-four hours, it will be found, at the end of that time, both warm and moist. It is to this that I attribute its highly beneficial action, and the very favourable and satisfactory results of its employment in numerous cases.

"Besides these advantages of the new epithem, its little bulk and extreme lightness render it of very extensive application. Thus, it is well adapted for all parts, however uneven, and for all cases, where heat and moisture are required, of no matter how painful a character, as in the former it can be retained in its place with the greatest facility, while in the latter it causes not the slightest inconvenience to the patient. Nothing can be more disagreeable than the ordinary poultices when applied to the head or face, or to the groins, in which latter situations they can be but very imperfectly retained, in consequence of their weight and pultaceous nature. In these cases the superiority of the 'Impermeable Spongio-Piline' must be at once apparent. For the first, it constitutes a 'delightfully soft,' warm, and soothing application, free from any unpleasant smell; and for the second, is extremely useful in enabling the working man, whose maintenance, as well as that of his family, depends upon his exertions, to go about his usual avocations, with the swelling covered by a comfortable, light, convenient, and beneficial cataplasm.

"Another great advantage of this article is, that it can be had of various shapes—as gloves, for instance—and of any size, so that a whole limb, and even the whole body, if necessary, may be poulticed with the greatest ease, it being, in fact, a ready-made cataplasm, so to speak, requiring only to be impregnated with hot water to be fit for use. A vast amount of time and trouble is thus saved, and all chance of the poultice being badly made avoided; for I may mention that, although so common, or rather popular, a remedy, but few persons know how to form it.

"It may also be had of any thickness, so that it is applicable, not only as a substitute

for poultices and fomentations, but also for the 'water-dressing,' in which, in addition to its answering the purpose of the oiled silk in keeping the lint moist, it has the effect of absorbing any discharge that may take place from the wound.

"Moreover, it is cheaper than anything ever yet employed; and when this is considered, together with its unobjectionable qualities, it is evident that to hospitals, dispensaries, and other charities, and to the poor in particular, who can but very ill afford the expense attendant upon a long-continued course of poulticing, especially with bread, the 'staff of life,' this article must be invaluable. In short, it will, I think, be acknowledged by all, from what I have stated respecting it, that I am sufficiently warranted in confidently recommending it.

"The principal object in using the 'spongio-piline' is to impregnate it with as much liquid as it can conveniently hold without running out. This may be done either by placing the epithem on the surface of the water, and allowing it to completely saturate itself, the superabundance being afterwards expressed by gently passing the hand across it, or by pressing the fluid from the borders; or, secondly, by placing it on the hand or on a table, and pouring the water upon it.

"By impregnating it in this way, we avoid wetting the backing, and thus save the time that would be then necessary for drying it, and likewise run no risk of moistening the patient's linen."

REPORT MADE BY THE COMITÉ DE REDACTION OF THE JOURNAL DE CHIMIE MEDICALE, ON THE NOTES AND OBSERVATIONS THAT HAVE BEEN ADDRESSED TO THEM ON THE ECONOMICAL EXTRACTION OF IODINE FROM IODURATED BATHS.*

The Société de Chimie Medicale, since it gave notice, in December last, of its intention to award a silver medal to the author of the most simple and enconomical process for extracting iodine from iodurated baths, has received twelve series of observations on this important subject.

The different authors have proposed in their notes, either to precipitate the iodine by means of starch, or (and this is the means most generally pointed out) to decompose the iodide of potash by one or more metallic salts, so as to form an insoluble iodide, or one soluble to a trifling extent, from which the iodine is to be afterwards removed by a new reaction.

In giving an account of the proposed methods, we shall adopt the order in which the memoirs have been published.

1. M. Labiche's memoir, in which M Chantrel took a part, was published in December, 1845. This pharmacist has proposed to proceed either by the precipitation of iodine, by means of starch or fecula, or by the absorption of the metalloid by means of charcoal, disengaged from its combination by chlorine. He afterwards separates the iodine by treating the iodide of starch with sulphuric acid, and with the assistance of heat, or by calcining the iodated charcoal with potash. This method is scarcely practicable on a large scale, in the opinion of your reporter.

2. In the letter forwarded by M. Legrip, this practitioner proposes to precipitate the whole of the iodine of an iodurated bath, by neutral acetate of lead, the result is an iodide of lead, but slightly soluble, which he collects by decantation, and decomposes by hot concentrated sulphuric acid, in a glass or earthenware retort, after having dried it.

3. M. Regnault suggests two processes to separate the iodine from Dr. Lugol's iodurated iodide of potash, and from Dr. Pierquin's bath of protoiodide of iron. He reduces these baths to the state of simple iodide of potash, either by acting on the first by means of potash, and on the second by carbonate of potash; this reaction being completed, he decomposes the iodide of potash with bichloride of mercury. The mercurial iodide formed being collected, he mixes it with 42 per cent. of its own weight of carbonate of potash, and distils the mixture; he thus obtains, on the one hand, metallic mercury, and on the other, fixed iodide of potassium, which remains at the bottom of the retort. This compound potash, newly dissolved in water, is afterwards obtained by crystallisation.

4. M. Harley also proposes to decompose the water of iodurated baths by acetate of lead; as to the iodide of lead thus formed, he treats it with a solution of protosulphate of iron, to convert it into an insoluble sulphate of lead, and a soluble protoiodide of iron. It is from this iodide, obtained by evaporation, that he extracts the iodine, by acting on it in a retort, by sulphuric acid and peroxide of magnanese.

5. M. Giovanni Righini points out in his memoirs three processes for its extraction, the two first consisting in the production of an iodide of lead, which he afterwards decomposes by means of heat and sulphuric acid; and the third, the separation of the

* *Journal de Chimie.*

iodine from an iodurated iodide of iron, obtained by the action of iron filings and sulphuric acid on the water of the bath, and afterwards decomposing the product obtained by biohloride of mercury. In the description of these processes, there are several points which have appeared not very reasonable to your commission. Among others, that of mixing the iodine obtained with iron filings, to be afterwards purified by distillation. Independently of the inconvenience of the method pointed out by M. Righini, a great portion of the iodine must remain combined with the iron, in the state of a fixed iodide of iron.

6. M. Cottereau, jun., proposes to modify the decomposition of iodurated baths by acetate of lead, by acting on the iodide of lead thus formed, by means of heat and a solution of carbonate of potash, or by a solution of sulphate of potash. The iodide of potash, regenerated by this reaction, is afterwards obtained by evaporation, and purified by crystallisation. The author dwells upon the fact of sulphate of potash being a commercial article less expensive than the carbonate of the same base.

7. The communication of M. Giovanni Ruspini, has, for its object, the employment of acetate of lead and the decomposition of the iodide of lead by sulphuric acid and peroxide of manganese.

8. The process recommended by M. Bouysson is analogous to the proceeding; it differs from it only by the employment of subacetate of lead, instead of the neutral acetate.

9. M. Leudet has applied the combined action of bisulphate of copper and metallic copper on the iodurated iodide of the baths. He thus transforms the whole of the iodine into protoiodide of copper, which he afterwards decomposes by hot sulphuric acid and peroxide of manganese.

10. M. Cottereau, in a note in addition to his first memoir, recommends the subacetate of lead and the decomposition of the iodide of lead by carbonate of potash.

11. M. Clement has applied the processes of Messrs. Berzelius and Soubeiran for the extraction of the iodide of the mother waters of kelp potash; he precipitates the iodurated baths by a mixture of protosulphate of iron and bisulphate of copper, and decomposes the iodide of copper obtained by means of carbonate of soda—a low-priced salt. The result of this reaction is a soluble iodide of soda, which he employs in that state for the preparation of a fresh bath by the addition of a sufficient quantity of water. This process appears to us to be economical, since it dispenses with the necessity of evaporating the liquid containing the iodide, which can be employed several times in the preparation of an iodurated bath.

12. M. Minard employs acetate of lead to precipitate the iodine from the bath; but he afterwards treats the iodide of lead with caustic potash, and decomposes the product by sulphuric acid with the assistance of heat. The same author proposes to convert the iodide of lead into the iodide of potash, by dissolving the first in boiling water, and precipitating by a solution of carbonate of potash.

To sum up all the different methods we have passed in review, as it were, are founded on the previously published processes of Messrs. Berzelius, Liebig, and Soubeiran, for extracting iodine from the mother waters of kelp potash; they, therefore, offer no originality of character. On this account the commission, by their reporter, do not think they should grant the silver medal; but considering the efforts made by the different authors to answer the question proposed by the Society, it proposes, by way of encouragement and honourable notice, to grant six bronze medals to those who have most nearly attained the proposed end. Namely, to M. Legrip, M. Cottereau, jun., M. Leudet, M. Clement, and Messrs. Labiche and Chantrel.

FRENCH WEIGHTS AND MEASURES.

MEASURES.

Millimetre.. =	0·03937079	English in.
Centimetre .=	0·3937079	,,
Decimetre.. =	3·937079	,,
Metre .... =	39·37079	,,
Decametre.. =	393·7079	,,
Hecatometre =	3937·079	,,
Chiliometre .=	39370·79	,,
Myriometre .=	393707·9	,,

Note.—1 Eng. inch = ·0354 French metres.
10,000 Eng. feet = 305 metres, very nearly.

SUPERFICIAL MEASURE

		Eng. yards.
1 Are ... =	a sq. decametre =	119·6046
1 Decare .=	10 sq. are =	1196·046
1 Hectare.=	..... =	11960·46

MEASURES OF CAPACITY.

1 Millilitre.... =	·061027	cub.in.En.
1 Centimetre .. =	0·61628	,,
1 Decimetre .. =	6·1028	,,
1 Litre = 1 cubic decimetre =	61·028	,,
1 Decalitre.... =	610·20	,,
1 Hecatolitre .. =	6102·8	,,
1 Chiliolitre .. =	61028·	,,
1 Myriolitre .. =	610283·53·71	cubic feet.

SOLID MEASURE.

Decistere.....	= 3·5317	cubic feet.
Stere = a cubic metre	= 35·317	,,
Decastere.....	= 353·17	,,

The next table represents the names and ratios of French weights:—

WEIGHTS.

1 Milligramme ..	= ·07544	Eng. gr.
1 Centigramme .	= ·75445	,,
1 Decigramme ..	= 7·54457	,,
1 Gramme.....	= 75·44579	,,
1 Decagramme ..	= 754·45793	,,
1 Hecatogramme	= 1544·57938	,,
1 Chiliogramme .	= 15445·79386	,,
1 Myriogramme .	= 154457·9386	,,

Note

1 inch	Eng. =	·02547 metres.
1 foot	,, =	·30492 ,,
1 yard	,, =	·91476 ,,
1 lb. avoird.	,, =	·453½ gramme, very nearly

EXPERIMENTS ON THE HUMAN FÆCES.

BY BARON LIEBIG.

A series of experiments which I made on the relations of the fæces to a solution of grape sugar (to which was added tartar, a substance which, according to the experiments of H. Rose, singularly promotes and accelerates fermentation, when commencing) have led to the following observations:—

The fæces of a sucking child, which, under the miscroscope, appeared to consist, for the most part, of epithelial cells, swelled by moisture, caused, during three days, no fermentation in the solution of sugar; on the fourth day, bubbles of gas appeared; on the fifth, a regular fermentation set in, and the sugar disappeared. By distillation, there was obtained a thoroughly well-flavoured spirit. As soon as the fermentation set in, the so-called fungi of fermentation appeared.

The fæces of a healthy adult, in two other experiments, produced no fermentation, even after five days.

Those of a second individual, suffering from weak digestion, produced in the saccharine solution, by the end of the first day, a feeble fermentation, in consequence of which the fæcal smell entirely disappeared. By distillation, there was obtained a very small quantity of alcohol, of a most offensive smell, as of putrid cheese. When the same person had taking, fasting, a certain quantity of salt and water, to promote the action of the bowels, and the consequent evacuation was richer in swollen epithelial cells, a perfect fermentation took place.

Healthy human fæces, therefore, posses the property of exciting fermentation, when they have themselves passed into a state of fermentation or putrefaction; but they acquire this state only after being expelled from the body, and when subsequently exposed to the air. The disappearance during fermentation of their peculiar fœtor is itself a fact full of significance with respect to the view to be entertained of their true nature. The disengagement of gases which goes on in the intestinal canal of persons who are out of health, or affected with disease, shows the facility with which the fæcal matters, from causes operating within the body, may pass into decomposition analogous to putrefaction.

It may perhaps not be unimportant to the decision of the question as to the nature of the fæces, if I direct the reader to the fact, that it is easy, by an imperfect oxidation of albumen, to produce the peculiar substance to which the fæces unquestionably owe their peculiar fœtor.

If we heat in a retort one part of white of egg and three of hydrate of potash, so as to melt the mixture, and continue the heat till the disengagement of ammonia has nearly ceased, and if we then supersaturate slightly the contents of the retort, after cooling, with dilute sulphuric acid, and distil, we obtain, along with a disengagement of carbonic acid and sulphuretted hydrogen, a liquid which is slightly acid (from the presence of acetic and butyric acids), and which has a most horrible fæcal smell. The substance to which the smell belongs is soluble in water and alcohol; it combines with alkalies, without, however, neutralising them; when exposed to the air, it is rapidly changed.

By means of caseine, gelatine, and fibrine, when treated in the same way, we can procure all the different varieties of fæcal odour.

A NEW METHOD FOR DETECTING SPURIOUS MUSK-PODS.*

BY J. MOORE NELIGAN, M.D.

Owing to the high price and great demand for musk, both as a medicine and a perfume, it is very generally much adulterated. This fact is so well known to apothecaries and to druggists, that those who have even a moderate consumption of the drug prefer purchasing it in the unopen musk-bag, or, as it is technically called, musk-pod. This precaution, however, is often found not to be a sufficient protection against fraud, as spurious musk-pods are not uncommon in com-

* *Dublin Journal of Medical Science.*

merce, so well prepared that even the most experienced eye is often unable to distinguish the true from the false.

It is now very generally known that musk is the peculiar secretion of a small sac situated immediately in front of the preputial orifice of the male musk animal, the *moschus moschiferus*, and that it is principally imported into the British market from China. The Chinese, finding a greater demand for musk than they are able to supply with the genuine article, squeeze out some of the secretion, which is fluid in the recent state, and mix it with, it is believed, the dried blood of the animal; this compound, which presents the same physical characters as true musk, they put into small sacs made of pieces of the skin cut off from other parts of the animal's body, and prepared with the usual ingenuity of this people, so much so, indeed, as almost to defy detection with the naked eye.

The method hitherto adopted for detecting this sophistication has been the peculiar position of the hairs, which are arranged in a circular manner around the orifice in the genuine musk-pod; and also the absence of any remains of the penis in the artificial pods. But those characters are not invariable, and I have seen some spurious musk-pods which were so skilfully prepared as to be undistinguishable from the genuine article when compared with them.

The plan which I propose depends on the microscopic characters of the hairs which grow on the preputial sac of the musk animal, and which, as far as I have been able to detect by direct experiment, differ very remarkably from those of the false sacs which are met with in commerce. This test I have recently had an opportunity of pointing out to my friend Professor Christison, of Edinburgh, and of illustrating it to him from specimens in his own museum.

The difference appears to depend on the fact, that the hairs of this part of the animal are furnished in the interior with distinct, regular, coloured cells, while in hairs taken from other parts of the animal's body those cells appear to be obliterated, as is generally the case in this and the allied tribes of animals.

The method I have now proposed is a very simple one, and of easy application, and cannot be considered too scientific in the present day, when every pharmaceutist must be supposed to be provided with a microscope at the least of the power above spoken of, without which he could not possibly detect the adulteration of arrow root and of the other feculas of commerce.

CASE OF POISONING BY OIL OF VITRIOL AT WANDSWORTH.

When we inserted, in our last number, the reprint of a letter that appeared in the pages of the *Lancet*, we had not the most remote idea of giving reasonable offence to Mr. A. S. Taylor, or his friend. The statement was inserted because it was an apt illustration of the chance of error in giving chemical evidence without previous experiment.

Mr. Taylor has forwarded us a pamphlet, in which the evidence given by the surgeon is reported as follows, together with the witness's explanation:—

"What strength of diluted sulphuric acid would serve to produce such injuries as you saw?—The dilute sulphuric acid of the Pharmacopœia, which is one-fifteenth acid to fourteen-fifteenths water, or thereabouts, would produce injury to the mucous membrane of the mouth; but what I saw must have been produced by a much stronger fluid. An overdose of that aniseed might embarrass a child, but would produce no dangerous effects.

"By a Juryman: What would be the difference, if any, in the appearance of vitriol and water, and aniseed and water, when separately mixed; and would either two, when mixing, produce any effervescense, or other effect which would distinguish them one from the other?—Hot water, as in this case, being added to the aniseed, with a lump of sugar, some bubbles would escape from the surface whilst the sugar was dissolving; but in mixing sulphuric acid and water hot, the fluid would remain clear. There might be a trifling difference perceptible afterwards in the colour of the mixture.

"By Mr. Locke: An ordinary person might not notice any difference in the two fluids, contained as they are in two bottles so similar, unless their attention was directed to it. I should discover it.

"On further reflection, it occurred to me, that I had not included the sugar in speaking of the mixing sulphuric acid and water, in answer to the juryman's question; and bearing in mind that Mrs. Barker had invariably asserted, and had that day sworn, that she had put aniseed first, then sugar, and lastly water, I produced in court a mixture of one drachm of sulphuric acid, with a lump of sugar, and then a drachm of water added to them. The result gave a black fluid, of a very high temperature. Mr. Locke begged to know if I had mixed the three ingredients in the following order—the acid first, then the water, and, lastly, the sugar. I said, no. He asked me what would be the effect. I said, I thought something similar to the other

mode. He then begged me to make such a mixture before the court, telling me to put *double the quantity of water* to that before used. This I did, and the effect was a deep yellow fluid, of intense heat, and which gradually became darker on cooling. The quantity of sugar left for this experiment was only a few grains. This Mr. Locke described as a mistake, and said *it went to prove the possibility of Mrs. Barker's having used the vitriol in lieu of the aniseed.* Now Mrs. Barker, in all her examinations, including her evidence that day in court (and her statement on this subject was confirmed by the prisoner herself, on the night of the accident), had stated most distinctly that she put the aniseed first in a cup, then a lump of sugar, and afterwards added hot water out of the teakettle; so that, had she used vitriol instead of aniseed, an ebullition would first have taken place, and then a black fluid product at a very high temperature would have appeared around the sugar, surely calculated to arrest her notice ere she administered it to the child as an aniseed mixture."

On this and the evidence of the mother of the infant, Mr. Taylor observes, reflecting at the same time on the statement of the correspondent of the *Lancet*—

"A very erroneous *ex parte* statement, in reference to this subject, has been lately published in a medical periodical, communicated by Mr. J. J. Harrington, attorney for the prisoner. Although it had been distinctly sworn on the trial by a witness (Mrs. Baker) who could not have known the importance, in a chemical point of view, of her answers, that the sugar and liquid (whether aniseed or vitriol) had been mixed *before* water was added, the writer assumes that the water and aniseed were most thoroughly intermixed before the addition of sugar; and contends, from his own experiments, that the medical opinion given by Mr. Tatham, which, as it will be seen, was based upon *sworn evidence*, and not on any assumption of his own, was erroneous. It is only fair to suppose that Mr. Harrington could not have known that the results, arising from the mixture of vitriol, sugar, and water, depend materially on the *order* in which the substances are mixed: for there is no apparent reason why he should have suppressed a fact so important, and so necessary to the formation of an opinion as to the truth or error of the chemical testimony. As it is, the reader is left to conjecture how, and in what way, the witness (Mrs. Barker) had mixed the ingredients alleged to be poisonous. The fact that the contents of the stomach were completely *charred* to a tarry liquid renders it almost unnecessary to discuss the question, whether the liquid swallowed by the child would, or would not, carbonise sugar; since, according to my experiments, which are only confirmatory of those of other chemists, sulphuric acid, which is so diluted as not to carbonise sugar, will certainly not charr blood, mucus, or mucous membrane. Nevertheless, as it will be seen by the mode in which the learned counsel dealt with Mr. Tatham's evidence, this, which I believe to be a chemical impossibility, was forced upon the jury as a truth—'There was no *change of colour*, as they the jury had seen. Therefore, the mistake might have been made by Mrs. Barker!'

"Mr. Harrington goes so far as to assert, in the paper referred to, that the innocence or guilt—indeed the hanging of the accused—depended on the simple fact, whether sugar would, or would not, be carbonised under the circumstances. If this view be correct, and if there be any faith in chemical experiments, repeatedly performed, he has unintentionally, but conclusively, proved that the accused was guilty; for when the ingredients are put together in the order and proportions sworn to, the mixture becomes invariably blackened, whether the acid, sugar, or water, be added first; always provided the acid and the water be not in the first instance well shaken and mixed. If, however, an individual be permitted to assume that the three substances were mixed in an order different to that repeatedly sworn to, and to draw an inference from this assumption contrary to the evidence adduced, it would be better to assume at once that no sugar was used. It appears to me that we are bound to take the experiment according to the evidence, when there cannot be the slightest suspicion of fabrication, or to reject it altogether. We have no right to twist facts of this kind to suit our own particular views. Mr. Harrington cites this as a case showing with what caution what he calls "speculative" chemical testimony ought to be received in Courts of Law; but the result of this investigation appears to me to show that a Court should exercise the greatest caution in not allowing itself to be imposed upon by chemical experiments entirely at variance with the facts proved. Let us suppose that it had been given in evidence that the liquid (aniseed or vitriol) had been well mixed with water before the sugar was added,—Would a medical witness have been permitted to express an opinion unfavourable to the prisoner from results obtained by an *inverse mode* of performing the experiment? Assuredly not. Yet, what would have been denounced as gross deception in *medical* evidence, was received without comment as *legal* evidence in favour of the accused."

IV. REVIEWS AND NOTICES OF BOOKS, &c.

ANIMAL CHEMISTRY, OR CHEMISTRY IN ITS APPLICATIONS TO PHYSIOLOGY AND PATHOLOGY. By Baron Liebig. Edited by W. Gregory, M.D., F.R.S.E., &c. Third Edition. Part I. London: Taylor and Walton.

This is the first part of a new and greatly enlarged edition of Liebig's Animal Chemistry; and contains the "the Chemical Process of Respiration and Nutrition," and the first section of the "Metamorphoses of Animal Tissues." The latter is entirely new, and is "devoted to a consideration of the method which ought to be followed, and of the principles which ought to guide us in the investigation of that important subject." Want of space prevents us this month from entering more fully into the important subjects treated on in this valuable work.

BECKMANN'S HISTORY OF INVENTIONS, DISCOVERIES AND ORIGINS. Translated by W. Johnson. Fourth edition, carefully revised and corrected by W. Francis, Ph.D., F.L.S.; and J. W. Griffith, M.D., F.L.S. Vol. II. London: H. G. Bohn.

We have here the completion of this very useful work, which is rendered more valuable by the notes and corrections of its able and industrious editors. Mr. Bohn is entitled to great praise for the admirable manner in which this work is put before the public: and we can only account for the marvellous cheapness at which it is published, by referring it to the mighty powers of steam; by which "literature is cheapened, and, by being cheapened, diffused."

THE SURGICAL, MECHANICAL AND MEDICAL TREATMENT OF THE TEETH; INCLUDING DENTAL MECHANICS. With 139 engravings. By James Robinson, Surgeon-Dentist to the Metropolitan Hospital. Webster, 60, Piccadilly.

Dental Surgery, of late years only, has attained the rank and assumed the station and importance to which it is so justly entitled; and this is mainly owing to the superior education and qualifications of those who have devoted themselves to it—who, by their character and conduct, have raised it from the questionable position it formerly occupied in the eyes of the public; and by their writings and discoveries have not only caused it to be looked upon in the present day as a branch of a liberal profession, but one of vast scientific importance in the human organisation. Mr. Robinson has divided his treatise into two parts; the first commencing with the history of the art—after which he proceeds to explain, by well-executed engravings, the original formation of the teeth; their position at first; infantile diseases from teething; the foundation and advancement of the second set; prevention of irregularities; causes of caries, and method of stopping, &c.

In the treatment of irregularity by mechanical means, the author has shown great mechanical ingenuity in the invention of a series of contrivances for correcting those deformities, as also in the invention of instruments used in extraction, &c.

The second part is wholly practical; containing an elaborate and well-arranged treatise on mechanical dentistry; in which every manipulation connected with the manufacture of artificial teeth, gold plates and springs, swivels, suction-pieces in bone, alloys of gold, assaying, as applied to the dental art; all of which are minutely and handsomely illustrated. The work concludes with two important and interesting chapters on dentonomy and dental education.

CHEMISTRY AND PHYSICS IN RELATION TO PHYSIOLOGY AND PATHOLOGY. By Baron Justus Liebig, M.D., F.R.S. London: Baillière.

The work now before us, although written in a singular style—for, in fact, it chiefly consists of a series of axioms, suggestions, and deductions from established data—is admirably adapted to excite the mind of the reader, and produce a stream of deep and useful thought: it is a text-book on which many a useful essay might be written;- of this our readers can judge for themselves, by the following extract from the commencement of the work:—

"DEVELOPMENT OF THE NATURAL SCIENCES.

"The history of science teaches us, that every branch of physics comprised at its commencement nothing beyond a series of observations and experiments, which had no obvious connection with each other.

"SPECIAL LAWS OF NATURE.

"All advances in science were dependant upon the discovery of new facts, by which two or more previously observed experiments were made to bear upon each other. The first step gained was the deduction of special laws, which embraced in themselves the connection of a certain number of natural phenomena; the next was the attainment of general laws, or, what was the same thing, of certain expressions of the dependance or connection of a larger or smaller series of experiments.

"GENERAL LAWS OF NATURE.

"Many branches of physics as mechanics, hydrostatics, optics, acoustics, the theory of heat, &c., have been elevated to the rank of abstract sciences, in consequence of their permitting all known cases of the phenomena of motion, air, sound, heat, &c., to be traced through a series of syllogisms to certain truths, or to a very small number of undoubted facts, which not only unite together those already known, but also those yet remaining to be discovered; so that a new isolated series of conclusions is not requisite to the explanation of new phenomena or experiments.

"PHYSIOLOGY AS A DEDUCTIVE SCIENCE.

"The opinion that every empirical science, including physiology, may in the course of time acquire the character of a deductive science seems to require no confirmation; and it must be immaterial whether this position be attained by borrowing from other sciences: as for instance, in the case of astronomy, which owes its scientific basis to its partial incorporation with the theory of motion.

"THE DIFFERENCE BETWEEN THE CHEMISTRY OF THE PRESENT DAY AND THAT OF AN EARLIER AGE.

"No one who is conversant with the history of the development of chemistry, and of many other branches of physics, will deny that the main reason of the advance of these sciences rests upon the gradually confirmed conviction that every natural phenomenon has more than one requirement, every effect more than one cause, and that it is the simple inquiry into the plurality of these conditions, and the separation of effects which distinguish the chemistry of the present day from that of former times. A speedy termination was put in the period of phlogosis to all research by assuming principles of dryness and humidity, heat and cold, combustibility, acidity, volatilisation, &c., ascribing a special essence to every property, the explanation of which was included in the simple description of the phenomenon.

"The fluctuation in weight which bodies manifest on being submitted to chemical processes was regarded as a property of matter similar to the effervescence of limestone when acted upon by acids. There was a theory for the respective phenomena of combustion and calcination, although the relations of weight were not regarded as in the province of earlier chemistry. It was left to physiologists to explain how a body could have an increase of weight after losing one of its constituents; and further, how, under any circumstance, a body can show a fluctuation in weight. The increase of weight in calcination was an accidental property, peculiar, as it was supposed, together with many others, to metals."

The following ideas on fermentation and the parasite theory, deserve perusal:—

"FUNGI AND INFUSORIA DO NOT OCCASION PUTREFACTION.

"It has not escaped the advocates of the parasite theory, that a close connection exists between putrefaction, contagion, and miasma; although they avoid entering upon an explanation of the mode of comprehending the connection of these phenomena, and their mutual dependance upon each other. This connection would be established if it were proved that infusoria or fungi induced putrefaction or fermentation; that by them and their process of digestion and respiration, sugar is resolved into equal volumes of carbonic acid gas and vapour of alcohol; and that the following conversions are brought about, viz., urea into carbonate of ammonia; salicin into sugar and saligenin; sulphate of protoxide of iron into sulphuret of iron; sulphate of lime into sulphuret of calcium; sulphate of soda into sulphuret of sodium; blue indigo into white indigo; starch into sugar; sugar into lactic acid; amygdalin into prussic acid, bitter oil of almonds, and sugar.

"The following remarks will show how thoroughly untenable are these views:—

"OPPOSITION BETWEEN PUTREFACTION AND THE PROCESS OF LIFE.

"The constituents of vegetable and animal structures have risen under the dominion of

an active cause of change in the form and properties of organisms; and this is vital force, which decides the direction of attraction, and opposes the force of cohesion, heat, and electricity, destroying the influence of every cause that hinders the association of atoms in combinations of a higher order without the organism. In compositions of such various nature as the organic atoms, these other forces occasion a change of form and condition, when the vital force after death no longer opposes their action. The same leaf, or the same grape which possessed the capacity of giving off pure oxygen to the atmosphere, submits to the chemical action of the oxygen from the moment of its separation from the organism, and its being brought in contact with the air.

"No organism—no portion of an animal or plant is capable, after the extinction of vital energy, of resisting the chemical action which air and humidity exercise upon it, and its elements fall back under the unlimited dominion of chemical forces. Fermentation and putrefaction are the stages of its retrograde development, presenting less perfect combinations, until at length the organic atoms, in consequence of continuously acting inorganic forces, return to their simple original forms, in which they may serve for the development and nutriment of new generations.

"FUNGI AND INFUSORIA ARE SUBJECTED TO PUTREFACTION, FERMENTATION, AND DESTRUCTION.

"Fungi and infusoria are organic beings with constituent parts of the same composite nature as those of the higher orders of vegetables and animals, and we observe the same phenomena in their bodies after death, as those which accompany the disappearance of all organisms, and find them in a state of putrefaction, fermentation, and corruption; how then is it possible to regard fungi and infusoria as the causes of these processes, when they themselves become putrid, fermented and corrupt, leaving nothing but their inorganic skeletons?

"FUNGI AND INFUSORIA ARE THE ATTENDANTS, BUT NOT THE ORIGINATORS OF THE PROCESS OF PUTREFACTION.

"No one will deny that fungi and infusoria are found in a great number of putrefying and corrupting substances; but the frequency of their appearance cannot possibly be adduced as a motive for regarding them as the causes, instead of the attendants of these conditions. Fungi and infusoria are shown by nature, in reference to their nutriment and development, to be organic atoms, which have ceased to be parts or constituents of living organisms, and, in most cases, they do not appear until putrefaction be established, or is complete, and the process of corruption has begun. It cannot be doubted that all processes and their respective products are changed by their presence, for by means of their process of nutriment and respiration, they accelerate solution, limiting its baneful influence upon the surrounding parts to the shortest possible period of time.

"FUNGI AND INFUSORIA HASTEN THE PROCESS OF PUTREFACTION AND CORRUPTION.

"If the process of putrefaction be terminated by the return of the elements of organic beings into carbonic acid, and carbonate of ammonia, it is clear that the period necessary to effect this conversion must be most perceptibly curtailed if the putrefying agent be a plantation of infusoria, millions of whom are busily engaged in leading the constituent parts of the body into a state of decomposition by means of their respiratory and digestive processes.

"BY THIS MEANS THEY BECOME THE ENEMIES OF THE PROCESS OF PUTREFACTION.

"It can no longer be doubted that nature has assigned to the infusoria the important part of being the enemies and opponents of all contagion and miasma; since the most incontrovertible facts have shown that the green and red infusoria are during their life, and the process of their propagation, sources of the purest oxygen.

In a similar manner fungi check putrefaction by converting to their own nutriment, the sulphurous and nitrogenous constituents of vegetables—the actual originators of corruption; and thus further, the general transition into the final products of corruption.

"THE NATURE OF YEAST.

"The views which the adherents of the parasite theory have formed as to the cause of putrefaction, mainly rest upon observations which have been made upon the formation of the yeast in the fermentation of wine and beer; but the investigations into the nature of the yeast are not yet closed, and it is to be presumed that the microscopic observations already made will be strengthened by further inquiry, and every doubt concerning its vegetable nature be thus set aside; yet even in this case the explanation regarding the separation of sugar into alcohol and carbonic acid, would admit of no other expression than that assumed by the chemical theory.

"RELATION OF THE YEAST IN SOLUTIONS OF SUGAR, IN GRAPE JUICE, AND BEER-WORT.

"It is a perfectly well-known fact that in spirituous fermentation, the elements of the sugar of grapes without any loss of weight, and those of the sugar of cane with an increase of weight, are given back in the form of carbonic acid and alcohol. We cannot here, according to our usual conceptions, speak of the conversion of the atoms of sugar to the nutritive and respiratory processes of an organic being. The weight of the yeast increases in the fermentation of the juice of the grape and beer-wort; but if we put the yeast in a solution of pure sugar and water, although the fermentation is equally produced, the yeast, in this case, instead of gaining, loses a portion of its weight; and by continuous contact of the same yeast with fresh sugar and water, it by degrees entirely loses the power of fermenting, while its weight constantly diminishes. In this case, as we see, one and the same action must be derived from two directly opposite causes, to one of which is ascribed the capacity for increase, and to the other the reverse of propagation. If we assume that the nutritive and respiratory processes of the fungi are dependant upon sulphurous and nitrogenous substances contained in their elements, and that the fermentation of sugar is an accidental phenomenon, accompanying the developing process of an organic being, then it is quite incomprehensible whence it arises that the fungi are not reproduced in a fluid, where there is present this chief requirement to their propagation, while they gain in weight as soon as sugar, the accidental attendant of this vital process, is added. If, for instance, in the juice of the grape, sugar be decomposed, and there is no free access of air, the remainder of of the dissolved sulphurous and nitrogenous substances will remain dissolved in the juice for years without undergoing any change; if sugar be then added, the fermentation begins again, and yeast is again separated; when the sugar is decomposed, its separation ceases, beginning again only on a new addition of sugar; and this continues until the fluid contains an excess of sugar.

"THE FORMATION OF YEAST, ALCOHOL, AND CARBONIC ACID ARE MUTUALLY DEPENDANT UPON EACH OTHER.

"From these facts we evidently obtain a reciprocal relation of dependance, as required by chemical theory, between the form and and properties of the sulpharous and nitrogenous body which is converted into yeast, and the new forms and properties contained in the atom of sugar; and it is clear that the condition in which the elements of the former stand during their association with the yeast, and their falling asunder into other products, is the cause of the manner in which the sugar separates. No organic beings or animals similar to fungi have ever been observed in any other form of separation of sugar, as, for instance, in its transition into lactic acid by means of an animal membrane, or in its transition into mannit, gum, butyric acid, acetic acid, &c.; nor in any other process of putrefaction or fermentation, have organic beings been perceived, which appearing invariably in the same form, control the nature of the products.

"VIBRIONES IN THE URINE.

"In many cases the presence of vibriones is detected in the urine during its state of putrefaction, while, in other cases, when the the urine putrefies, it is impossible to discover any organised being, and if the absence of vegetable or animal organisms is certain in one single case, where fresh urine has been decomposed by the putrefying white deposit which occurs in a state of putrefaction, the fact is perfectly sufficient to remove every doubt of the true cause of the putrefaction.

"FUNGI CONTAIN SUGAR.

"If further we show that, in all hitherto examined fungi, analysis has yielded a quantity of sugar, which, during the process of life, did not pass into alcohol and carbonic acid, but that, in the same fungi, spirituous fermentation occurs immediately after their death, and from the moment when a change in their colour and properties is perceived, every analogy is wanting to justify our regarding the vital process of these plants as the cause of fermentation. The action must rather be ascribed to the reverse of a vital process."

PRACTICAL INSTRUCTIONS FOR THE PROTECTION OF PERSONS AND PROPERTY FROM LIGHTNING. By William Sturgeon, Lecturer on Natural Philosophy. London: Sherwood.

We remember some years since, a work was published, entitled, "Death in the Pot," the title page being also ornamented with a death's head and crossbones; the object of the author was to point out the poisonous, or at least adulterated state, of almost every article intended for human food, and so effectually did he perform his task, that, on rising from a perusal of the book, the timid reader knew not in what manner to satisfy the

cravings of nature, so as to escape the danger of being poisoned or made ill. In like manner, the work now before us is sufficient to terrify a nervous reader, who would run about in despair during a thunder-storm, scarcely knowing where to fly for safety; witness the following fearful catalogue of—

"SITUATIONS AND OBJECTS TO BE AVOIDED.

Out of Doors.

Trees and tall hedges, and outhouses close to them.

Church steeples, especially spires.

The banks of rivers, canals, lakes, &c.

Gas lamp-posts.

Water pipes, pumps, and wells.

Stacks of newly gathered hay and corn.

Barns, and other outhouses, containing much new hay or corn.

Inside of stables having iron hay-racks, or containing much harness.

Those parts of stables, or other outhouses, having weathercock rods attached to them.

Keep off iron bridges.

Lightning rods.

Iron fences of all kinds.

Those ends of dwelling houses in which there are chimneys.

The wet walls of all buildings.

The wet sides of hay and corn stacks.

Iron gratings over the branches of sewers.

Iron posts for the protection of side paths in streets.

Brass or other metallic fenders, and plates, outside shop windows.

Railways and railway engines.

Wires of electric telegraphs.

Avoid mounting a horse, or a coach, and sheltering beneath an umbrella.

Within Doors.

Fire-places; especially those in which there is a fire.

Gas pipes, and water pipes.

Bell wires.

Gilt picture frames.

Looking glasses.

Gilt paper hangings.

Gilt cornices.

Book-cases, having much brass works.

Clocks.

Locks, hinges, and finger plates of doors.

Windows, in the frames of which iron weights are attached to the sash-cords.

Windows, having iron stanchions or bars.

Windows, the frames of which are of lead.

Windows of nurseries or bed-rooms in which iron bars are placed.

Iron and other metallic bedsteads.

Bedsteads of all kinds, if furnished with metallic curtain rods.

Iron gratings of prisons, workhouses, and other places.

Metallic doors of all kinds.

Metallic pumps in kitchens or cellars.

Water closets."

There are, however, some situations less dangerous than others, and they are thus enumerated:—

"SITUATIONS AND OBJECTS THE LEAST DANGEROUS TO APPROACH WITH PRECAUTIONS.

Out of Doors.

A sitting posture will be the safest in all cases.

The dry side of a fence wall, and not near trees.

The dry side of old hay, and old corn stacks.

The dry sides of buildings generally, which have no metal amongst the masonry, nor chimneys attached to them.

The inside of barns, sheds, &c., not containing new hay nor new corn; keep also near the middle of the floor, and shut all the doors.

The middle of a road when travelling.

If travelling on horse-back, dismount, and lead the horse when the lightning is very near, and upon no account stop at a rivulet to water the horse.

If travelling in a footpath across fields, avoid trees and hedges.

On no account put up an umbrella whilst lightning is near.

Servants mounted on gentlemen's carriages ought not to put up umbrellas.

Inside of a carriage is much safer than the outside.

Farmers and their servants ought not to carry scythes, pitch-forks, dung-forks, spades, crow-bars, nor pick-axes on their shoulders, during lightning.

Within Doors.

The general rule will be to keep as distant as possible from all those objects catalogued above, and in a sitting or recumbent posture, either on sofas or chairs at a distance from fire-places.

Select the largest room in the house in which there is no fire.

When no metallic curtain rods are attached to the bedstead, a feather bed, at a distance from a fire-place, and bell wires, is the safest place in the house.

Throw off metallic bracelets and chains, and lay aside watches.

Steel busks are always dangerous. Neither these nor metallic lace holes are safe to be worn during lightning.

Gentlemen's coats having metallic buttons ought to be taken off."

The truth of these facts no one can deny; but when we find them placed in array, and illustrated by a long list of fearful accidents by lightning, we may well conceive the effect likely to be produced upon some minds; as, however, the feeling of fear is less excited when the mind is employed in the performance of an active duty, we find the following directions to prepare for the visitation of an approaching thunder-storm, and most certainly the whole household need be active to have their arrangements completed in time :—

"As it is always prudent to have recourse to the best available means of protection that can be thought of when a thunder-storm threatens an immediate visitation, the following advice will be useful as a guide to the heads of families whose dwellings are not otherwise protected:—

"Connect the fire-grates of those rooms in which the family are sitting, with the pump handle, a gas pipe, water pipe, stream of water, spring well, or with any extensive iron palisade, as is most convenient, by means of copper wire, a little stouter than bell wire. The kitchen grate ought, also, to be connected in the same manner, with some of those objects, in order, that should the chimney be struck by lightning, the fluid may be led quietly out of the house without effecting damage within. The connecting wire may pass through the window beneath the lower sash, or by any other convenient means. A *double connecting wire* would be preferable to a single one, as it would not be so liable to be destroyed by lightning should any happen to traverse it.

"Persons sitting at a distance from the wire, in a room thus protected, would be comparatively secure, though a flash of lightning were to strike the chimney and traverse it down to the room. The protection would be still more secure if every fire-grate in the house were thus united to the external conductors already mentioned. By these means, furniture as well as persons would be secure. Two or three shillings' worth of copper wire, judicously distributed, would protect the interior of a large dwelling-house, and the inmates might rest in perfect security."

MISCELLANEA.

SIGNAL FAILURE OF MESMERISM.*

In addition to the "heavy blow and great discouragement" that the pretended science of mesmerism recently met with at Ross, we may recal to our readers the following facts, published some weeks ago in another medical journal:—"It appears that the 100*l.* note deposited for six months in the bank of Messrs. Ball and Co., which was, according to the terms of the advertisement in the public papers, 'to become the property of any person who, without opening the envelope in which it was contained, should describe every particular respecting the note—such as its number, its date, the bank at which it was payable, &c., and who should read three English words plainly written on a slip of paper which was contained in the same envelope with the note,' has not been awarded. The six months expired on the 31st of March, but the time was extended to the 18th of April, to meet the convenience of a lady, a professor of mesmerism, and the authoress of an ingenious book on the subject, who arrived from London in the beginning of the month, and who expressed a wish to have some time longer to prepare her *clairvoyance* for the test. Six months and seventeen days having expired, and no person having appeared at the bank to examine the envelope, it was opened on the 18th instant, in the presence of Messrs. Ball and Doyne, and one or two other persons connected with the establishment. The note proved to be a printed cheque issued by the house of Messrs. Ball and Co., for 100*l.*, payable to Œdipus or bearer, and dated the 1st of October, 1845. The English words (written on a separate slip of paper) were, 'To Œdipus alone.' Although no person applied at the bank to inspect the envelope containing the note, some communications were received from different parts of England, and one from America (but none from Ireland) containing mesmeric revelations respecting the number of the note; and one letter (from Plymouth) enclosed a picture, or (intended) fac-simile, of it. It is unnecessary to add, that these mesmerically-inspired persons were mistaken in every particular."

* *Provincial Medical and Surgical Journal.*

MEDICAL SOCIETY OF LONDON.

MONDAY, Sept. 28, 1846, was the first night of the session. The attendance of fellows and visitors was unusually large. The meeting-room of the Society has been much altered and improved, and the introduction of gas has given it a lively and pleasant appearance.

On taking the chair, the president gave a brief inaugural address. He said that this was the commencement of the seventy-third session of that, the oldest medical society in the metropolis, and the parent of all similar institutions in London. He dwelt on the usefulness of the Society, and the benefit it had afforded to science by its *Transactions* and discussions. He showed that it had maintained the dignity of the professional character, and had always been the determined opponent of quackery, in whatever shape it might present itself. He urged the fellows to renewed exertions, and concluded, by congratulating them on the prosperity of the institution.

A paper was read by Dr. Hughes Willshire, entitled, "On a New Era in Therapeutical Inquiry," but which, from the nature of the subject, can scarcely be abstracted from, or condensed. The great endeavour of the author was to show, that, comparatively with other branches of the science of medicine, therapeutics had but little advanced in progress towards the establishment of fixed and generally believed-in principles; that our time having been so exclusively occupied with morbid anatomy, transcendental physiology, and, more lately, the mysticisms of the German schools of chemistry, this was scarcely to be wondered at; but, that the time had now arrived when we were urgently called upon to devote our energies to the firm establishment of great and leading principles of therapeutic action. This was rendered the more necessary, from the fact, that the various *illegitimate* branches of art flourished in the discrepancies found to exist in the therapeutics of legitimate medicine. The author reviewed the various modes of curative procedure which had been adopted or recommended in pneumonia, syphilis, rheumatism, and rheumatic endocarditis; noticed some important changes attempted to be introduced in the practical application of remedial agents, as calomel and opium in inflammation, the value of which, in controlling this morbid action under the circumstances usually believed in as enabling it to do so, being doubted by some late writers; and considered, in detail, some of the reports of certain German hospitals, in which the treatment of severe and important diseases was conducted on the plan of the greatest expectancy of the most expectant school. In concluding, the author stated his belief, that the coming epoch in the history of medicine must be one characterised by the attention paid to the establishment of a great system of therapeutics; that we now knew sufficient about the morbid anatomy and chemistry of disease, to entitle us to relax our somewhat too exclusive attention to these subjects, and to devote the whole of our energies to the great object under discussion.

In the discussion which ensued, and which was supported by Mr. Headland, Dr. Golding Bird, Dr. Theophilis Thompson, Dr. Chowne, and Dr. Risdon Bennett, it was contended, that, however imperfect the present knowledge in reference to therapeutics, it could not be denied that the advances made in pathology, morbid anatomy, animal chemistry, and the collateral branches of medicine, had wonderfully improved our knowledge of disease, and of the means of explaining it. With respect to the improvement of our knowledge of therapeutics, from the study and observation of cases occurring in the practice of those whose plan of treatment consisted in the "greatest expectancy of the most expectant school," it was to be remembered, that the records of cases springing from this source were not only occasionally false, but when true, were so imperfect and unsatisfactory, that no just conclusions could be drawn from them; so many "false facts" tended to embarrass and obstruct, rather than to assist us in our progress. It could not be doubted that the *vis medicatrix Naturæ* had often a wonderful preservative power in disease, but it would be criminal in the practitioner of legitimate medicine to stand by and see an acute disease hurrying his patient to the grave, without calling to his aid those efficient means and remedies which science and experience had taught him to be those most likely to arrest the progress of the malady.

THE GUN-COTTON.

SINCE Schönbein made known to the world the explosive power to be communicated to cotton by chemical agents, a great many "discoverers" of the same article have started up. Among others we notice the names of Böttger, of Frankfort, Morel, of Paris, Dr. Otto, of Brunswick, M. Chodsko, a Pole, and a couple of others at Mayence, all pretenders to the invention. It does not appear, however, that any of them made their experiments until the recent announcements of Schönbein; and it would be more credita-

ble to men of science to call their experiments reproductions of Schönbein's (the original discoverer's) cotton. Dr. Otto, professor of chemistry in Brunswick, has published the following statement in the *Hanoverian Gazette*, which—supposing the constituents he mentions to be the true ingredients—leaves the process of its manufacture no longer a secret :—" Independent of Schönbein and Böttger, but relying on an observation of Pelouze, contained in p. 136 of the 1st vol. of my ' Manual of Chemistry,' I have succeeded in producing and exploding cotton, which, after a series of experiments, seems quite suited to supply the place of gunpowder. To prepare it, common, well-cleaned cotton is dipped for about half a minute in highly-concentrated nitric acid (the acid which I use being made by the distillation of ten parts of dried saltpetre and six of oil of vitriol), and then instantly placed in water, which must be often renewed, in order to free the cotton from the acid with which it is impregnated. Care must then be taken that all the knotty particles of the cotton are properly disentangled, and that it is thoroughly dried."

Dr. Otto fails in establishing his claim to originality, inasmuch as by his own account his first certified experiment was made on the 4th of October, while Schönbein's cotton was used in the Cornish mines in August last.

By the *Messager* we learn that M. Morel, a mechanical engineer of Paris, also claims to have invented gun-cotton; and experiments were recently made with his invention before some of the military authorities. The account of these experiments states that M. Morel " presented a box of cartridges ready prepared for small arms. Burned on the hand, it caused no sensible pain, leaves no stain, and produces no smoke. Dipped in water and pressed, and afterwards dried between two leaves of blotting paper, it preserves its fulminating properties. General Gourgaud fired a charge of fulminating cotton from an ordinary fowling-piece, at a distance of forty yards from the object at which he aimed. He fired a holster pistol at a distance of twenty-five yards, and a pocket pistol at a distance of ten yards. At forty yards a ball from the fowling-piece traversed a plank of beech of 0·35 centimetres thickness; at twenty-five yards the ball from the holster pistol lodged in the plank without perforating it; the ball from the pocket pistol made the same impression on the plank as that which might have been produced by a charge of ordinary gunpowder. The charge of fulminating cotton leaves scarcely any residue in the barrel. The recoil of the gun is extremely slight, and the report is not louder that of a large detonating cap. We cannot calculate on the effect which may hereafter be produced by the discovery of M. Morel. M. Chodsko, a Polish refugee, likewise presented a fulminating substance which has the appearance of cotton, and which was tried with an artillery musketoon, fired at forty yards. The ball produced the same effect as that fired by fulminating cotton, but it left a considerable deposit in the barrel. The cotton powder of M. Chodsko was compressed into a wadding in order to charge the gun, whilst the fulminating cotton was not. Both materials ignite by the blow of a hammer on an anvil, but not by the blow of a hammer on wood."

In juxta-position with these experiments, it will be interesting to place some which were recently made in the grounds of Mr. Barron, of Stanmore, under Professor Schönbein's superintendence, and reported in the *Athenæum*, of October 17, by a gentleman who witnessed them :—" Previously to trying its powers with fire-arms, the professor made several experiments to show its explosive properties and perfect combustion. He placed some gun-cotton upon a heap of the strongest and most easily-ignited sporting gunpowder. The cotton was then fired by heated platinum wire: and, although there were innumerable points of contact between the cotton and the powder, the former exploded so instantaneously as to leave the gunpowder unexploded. The gun-cotton explodes at about 400° of Fahrenheit, with a vividness of flame which is perfectly dazzling —leaving scarcely any residue behind. It has been stated that no smoke is emitted: this is erroneous. A slight smoke, or rather vapour, is thrown off; but it so soon disappears as to occasion no inconvenience. After repeated explosions of the cotton, the room in which the experiments were conducted was perfectly clear. It is difficult to over-estimate the advantages attendant upon the use of the gun-cotton in mines; since the smoke proceeding from the coarse gunpowder used for blasting purposes occasions so much annoyance and injury to the health of the miners. The experiments in blasting tried in the Cornwall mines a short time ago, were most satisfactory and conclusive in favour of the gun-cotton. Another of its strange qualities consists in its not being deteriorated by damp or wet. Some gun-cotton which had been steeped in water for sixty hours, and dried by exposure to the air, exploded with the same facility, and as instantaneously, as cotton which had not been wetted. Professor Schönbein stated that immersion in water for two months has not

impaired its explosive qualities in the slightest degree. The experiments with fowling-pieces and rifles are highly interesting and satisfactory. A gun charged with thirty grains of prepared cotton propelled an equal charge of shot with greater force and precision, at a distance of forty yards, than was done by the same gun loaded with a hundred and twenty grains of gunpowder. A rifle charged with fifty-four and a half grains of gunpowder sent a ball through seven boards half an inch in thickness, at a distance of forty yards: the same rifle charged with forty grains of gun-cotton propelled the ball into the eighth board. Another rifle, which had been used for elephant-shooting, and consequently carried a much larger ball, charged with forty grains of gun-cotton, propelled the ball through eight boards, at a distance of ninety yards. In no case was the discharge accompanied by a greater recoil than usual; and the reports were not louder than those accompanying the discharge of guns and rifles loaded with gunpowder. We understand that a hundred weight of gun-cotton is on its way from Basle to Woolwich; having been ordered by Government with the view of testing its applicability to heavy ordnance. Professor Schönbein states that the manufacture of the gun-cotton is unattended by risk; and that it can be effected in the small space of eight hours, and at a less cost than gunpowder. If these statements shall turn out to be correct, the adoption of the gun-cotton will follow as a matter of course."

The following letter on the same subject from Mr. Thomas Taylor, appeared in the *Times* newspaper, pointing out an improved method of preparing the article:—

"Many persons have requested me to give minute directions as to the making of the explosive cotton, and the proportions that should be employed. The following forms a good quantity for a class experiment, and with ordinary care always succeeds:—Mix in any convenient glass vessel 1½ ounce by measure of nitric acid (sp. gr. 1·45 to 1·50) with an equal quantity of sulphuric acid (sp. gr., 1·80). When the mixture has cooled, place 100 grs. of fine cotton wool in a Wedgewood mortar, pour the acid over it, and with a glass rod imbue the cotton as quickly as possible with the acid. As soon as the cotton is completely saturated, pour off the acid, and with the aid of a pestle quickly squeeze out as much of the acid from the cotton as is possible. Throw the mass into a basinful of water, and thoroughly wash it, either in successive portions of water, or underneath a tap, until the cotton has not the slightest acid taste. Finally, squeeze it in a linen cloth, and dry it in a water-bath. By employing a large relative proportion of the acids to the cotton, or by using stronger nitric acid, a still more highly explosive compound may be produced, but acid of the strength and in the proportions I have given affords a very useful article at a moderate cost. Nitric acid of the sp. gr. 1·50 answers much better than that of 1·45; it being a curious fact that the texture of the cotton is much less acted upon by the stronger acid. If the nitric acid has only the sp. gr. of 1·36, the cotton is often converted into a gelatinous mass, and I have no doubt but that in the majority of cases where persons have failed in repeating my process, the failure is owing to their nitric acid being too weak. By the ordinary acid of commerce I meant that of the *London Pharmacopœia*, which should be of the sp. gr. 1·50, but is seldom more than 1·45. When the very best cotton is required, it will be found advantageous to remove all adhering grease, by first washing the cotton in a weak alkaline solution, and thoroughly drying it before it is immersed in the acid. Being unwilling to detract in any way from the value of any other person's process without sufficient trial, I stated in my first communication that my process could only be regarded as a modification of that of Dr. Otto's; it is, however, something more, for I have carefully repeated Dr. Otto's process, using acid of the sp. gr. 1·512; and I may now venture to assert, that although a powerfully explosive cotton is produced, it is much inferior in strength to that made with the addition of sulphuric acid. The practical difficulties, moreover, which would be encountered in manufacturing it by his process would be almost insurmountable; and if acid of a still greater strength were employed, the expense would prevent its ever being more than an object of scientific curiosity.

"The cotton when well prepared should be perfectly white, and its microscopic structure quite unaltered. I have had so few opportunities of comparing the projectile power of gun-cotton with that of gunpowder, that I am unable to make any positive statement either as to the precise charge that may be used with safety, or its relative force. It certainly may be made much stronger than gunpowder; I should therefore recommend any who may be disposed to try it to begin with about a quarter of the weight which the gun requires when loaded with powder, and gradually increase the quantity until the proper charge is determined. I have fired 20 grains from an ordinary gun when loaded with a bullet, and two grains and a half of a rather inferior cotton in a two-grooved rifle drove the bullet through a deal board an

inch thick, at a distance of 70 feet. In guns provided with patent breeches the cotton does not always ignite, owing to the difficulty of getting the cotton into the chamber; but in rifles and guns of the old-fashioned construction it succeeds perfectly, whether ignited by a percussion-cap, or by flint and steel. Owing to the rapidity of its combustion, it will probably be found that the barrels should be rather stronger than those in common use. I do not think that any danger need be apprehended from the friction of the ramrod during loading, for I have always remarked that when struck by a hammer, only that portion is exploded which is immediately in contact with the metallic surface; as, however, there is not the slightest necessity for its being hard rammed, a wooden or bone end to the ramrod would answer every purpose. It is, I think, very questionable whether any cheaper material will form an efficient substitute for cotton. Dr. Leeson, Mr. Heisch, and myself, ascertained the fact with regard to tow in the laboratory of St. Thomas's Hospital, prior to my letter of the 17th. The tow acquired a feeble explosive power, but it left a large residue, and as a projectile agent appeared to be valueless.

"I perfectly agree with the judicious observations of your correspondent 'P.' as to the care that should be taken in using this substance. Gun-cotton is certainly a much less formidable compound than most of the fulminating powders, and in many respects is even safer than gunpowder; still it must be remembered that its properties are at present but very imperfectly known. It is not improbable that large quantities when dry may undergo spontaneous combustion. I would therefore recommend that until wanted it be kept in small quantities in a damp state, and even then in a place where, should it undergo decomposition, no danger could occur.

"In conclusion, I would observe that the explosive cotton of Schönbein, Otto, and myself, are an extension of the fact, long known to chemists, that various organic bodies, as paper, flax, cotton, &c., after being dipped into strong nitric acid acquire the property of burning with the greatest rapidity when ignited; and that the fact of rapid combustion and explosion being identical in principle, and differing only in degree, must be borne in mind by those who are making experiments upon the process or its applicability to other materials than cotton—a substance which appears to me to have been selected with considerable judgment by Dr. Schönbein."

Another correspondent in the same paper observes, in reference to the requisite charge:—

"I find that one grain of the carefully prepared article is sufficient to propel a ball (80 to the pound) from a small rifle most accurately at a range of 20 yards. From this it may easily be calculated what may be required for various purposes and at various ranges."

ON THE TEMPERATURE OF MAN.

BY JOHN DAVY, M.D., F.R.S.

A paper on this subject, read before the Royal Society, gives the results of numerous observations made with a particular instrument, constructed for the purpose, admitting of minute accuracy (each degree of the scale being divided into ten parts) and when used with the precautions pointed out, affording satisfactory indications in many problems which may be proposed relative to the temperature of man, &c.; but the author confines himself to a small number, offering the information he brings forward only as a preliminary contribution in aid of their solution.

The paper is divided into seven sections.

The first, treats of the variations of temperature during twenty-four hours. The author finds from his observations that the temperature is highest in the morning, on rising after sleep; that it continues high but fluctuating until the evening; and that it is lowest about midnight, ranging on an average from 98·7 to 97·9.

The second, of variations during the different seasons. These, he finds, bear some relation to the temperature of the air, but less than might be expected; which he attributes to the majority of observations having been made within doors, under circumstances peculiarly favourable to uniformity.

The third, of the influence of active exercise on the temperature. The effect of this, when not carried to the length of exhausting fatigue, he finds to be elevating, and that the augmentation is, within a certain limit, proportional to the degree of muscular exertion. The fourth, of passive, such as carriage exercise. The effect of this in a cool air, contrary to that of quick walking or riding, would appear to be lowering.

The fifth, of abstinence from all exercise in a cold atmosphere. This he finds to be depressing in a still greater degree; sitting in a cold church has occasioned a reduction of temperature of from one to two degrees, the air of the church being from 42° to 32°.

The sixth, of sustained attention or exertion of mind. This would appear to have

the effect of raising the temperature, but in a much less degree than bodily exercise.

The seventh, of taking food. It would appear that a light meal, such as breakfast, alters very little the temperature, whilst a heavy meal, such as dinner, with wine, tends to lower it.

The conclusion drawn by the author from his observations, considered in their greatest generality, is, that the temperature of man is constantly fluctuating within a certain limit, regularly, during the twenty-four hours, and irregularly, according to the operation of certain disturbing circumstances.

Should multiplied observations give similar results, he infers that they will admit of many applications, both as regards the regulation of clothing, the warming of apartments, and possibly the prevention and cure of diseases.

THE FORMATION OR SECRETION OF ALKALINE AND EARTHY BODIES, BY ANIMALS.

BY ROBERT RIGG, ESQ., F.R.S.

From a paper read before the Royal Society, it appears that, from the results of a comparison made by the author, of the weight of the ashes obtained from a quantity of bread, equal to that which was the sole food of two mice during thirty-eight days, with the weight of the ashes of their excretions during the same period, it appeared that the latter exceeded the former in the proportion of 1·334 to 934. The amount of soluble salts was also found to be greater in the latter than in the former. From these data the author infers that both alkaline and earthy bodies are formed out of their elements by the animal system, and found in their excretions.

ON THE APPLICATION OF PHOTOGRAPHY TO REGISTERING THE THERMOMETER AND BAROMETER.*

BY HENRY HENNESSEY.

The delicacy required in an instrument for registering continuously the indications of the thermometer or barometer, is such, that contrivances of a merely mechanical nature could never fulfil such a purpose. As I am not aware that the photographic process has been ever applied to effect this desirable object, I here present some account of my attempts at showing the practicability of such an application of that process. It occurred to me a few months since, that the shadow of the mercury, or whatever fluid may be used to indicate, by its oscillations, physical changes going on in the atmosphere, could be received upon a sheet of prepared photographic paper, or on a Daguerreotype plate. In proceeding to make the necessary experiments, I found that the common mercurial thermometer was not adapted for my purpose. No method in my power could prevent the light from travelling, as it were, round the column of mercury, and thus preventing the formation of a fixed shadow. It appears that the best method for obviating such an inconvenience would be to have the sides of the thermometer tube made of some opaque substance, while the front and back would each consist of a thin film of glass, equal in breadth to the bore of the tube. In the absence of such an instrument I used a spirit thermometer, the tube of which had a large bore and a small external diameter, this was inserted in a slip made in the side of a flat box, and the portions at each side of the spirit column were blackened. A sheet of photographic paper, prepared with the bromide of potassium and nitrate of silver, was placed on a plate of glass which was drawn by clockwork through the box; the plate was at the distance of nearly one-tenth of an inch from the column of spirit in the thermometer, and five feet from an open window. The window faced towards the east, but the direct rays of the sun did not fall on the apparatus during the experiment; as the plate passed before the thermometer a beam of light was thrown upon it, more or less high, according to the height of the spirit in the tube, or the temperature of the surrounding air, and a shadow, bounded by a defined line, was thus formed.

The imperfections of my apparatus having rendered the motion of the plate carrying the apparatus rather irregular, the shadow was not perfectly continuous, but a series of white spaces were interposed between each of the dark portions. The translucency of the coloured spirit, also, permitted some light to act upon the lower part of the sheet, making faint prolongations of the dark spaces.

In my first experiment, the temperature was registered in this way, for only five hours; in my second, the operation was carried on for nine hours, or from ten in the morning to seven in the afternoon. During the course of the last experiment, the sky was occasionally much obscured, so as to lessen the intensity of the light, and both experiments were performed during the same month—August.

* *London and Edinburgh Philosophical Magazine.*

When results so satisfactory have been obtained with such imperfect apparatus as that I have used, it is superfluous to anticipate what would take place under more favourable circumstances. The application of photography to register the height of the mercury in the barometer, ought to be still more practicable than in the thermometer, as in the former case the shadow, thrown on the paper would be so much broader than could ever be possible in the latter. I trust that I shall soon be able to present such facts on this portion of the subject as will effectually clear up all doubts. The experiments which I have made on the application of the Daguerreotype and calotype, although yet incomplete, have been satisfactory. From the researches of Professor Draper and others on the action of artificial light upon Daguerreotype plates, I have been led to hope that temperatures and barometrical oscillations can be registered, continuously, by night as well as by day. In using a lamp to produce a shadow of the fluid column in the instrument, it may at first appear that errors would be produced, from the circumstance that the shadow would not always have the same proportion to the column, but that such errors would be inconsiderable appears from the easily deduced formula—

$$\Theta = \frac{\theta l - m\ (H - h)}{l + m}$$

Where, in the case of a thermometer, Θ represents the number of degrees in the true temperature, θ the number recorded on the plate, H height of the bulb of the instrument above a horizontal plane, h the height of the flame of the lamp above the same plane, l the perpendicular distance from the flame of the lamp to a plane passing through the mercurial column, parallel to the plate, and m the distance from the mercurial column to the plate. A similar formula would give the true height of the mercury in the case of a barometer. If circumstances should render the correction obtained by the foregoing formula of any importance, tables could be easily calculated to facilitate its practical application.

HEAT AND ELECTRICITY.

A CORRESPONDENT in the *Lancet* thus addresses the editor :—

" Sir—I have observed, in the *Lancet* of February 7th, some remarks on certain effects of electricity, by Mr. Hill, of Filey, to explain the production of which, he would assume the specific heat proper to the body, under examination, to have been evolved. Mr. Hill states, 'there can be no other source from which this heat can have been derived,' an assumption which is, in my opinion, negatived by the very fact (if it be a fact) upon which his arguments are based —that is, the materiality of the electric fluid. Granting this materiality, we have no other alternative than to assign to it a similar constitution to all other species of matter that fall under our observation, and that constitution is, that it is composed of ultimate molecules or atoms, which atoms are not in contact, but have their spaces occupied by combined heat. Thus, the fluid possesses a specific heat, as well as the body subjected to its influence, and I think it quite as probable, nay more so, that the evolution of heat is caused by the neutral compound of the two electricities not possessing so large a capacity for heat as either when uncombined. I do not pretend to say that, in this manner, the effects cited by Mr. Hill are produced; that point I leave for others more versed in electrical science than myself to determine. However, I think the above remarks will disprove the statement of Mr. Hill, that the fluid itself cannot be the original seat of the heat involved.

ENORMOUS COPPER ROCK.

A LETTER addressed to the *Detroit Advertiser* gives the following account of a most remarkable natural production :—" You undoubtedly have heard of the enormous copper rock at Eagle-harbour location, pronounced by Dr. Petit, the great-grandfather of all the rocks of this kind, estimating its weight at from 75 to 100 tons. A brief description by an eye-witness may be interesting to your readers :—At Eagle-harbour, commencing at the shore of the lake, is an open cut, 12 feet wide, 85 feet long, 7 to 8 feet deep, in which is found this enormous mass of copper. The sheet, which is 90 per cent. pure copper, is in the centre, running the entire length of the cut, varying in thickness from 6 inches to 2 feet, having branches of from 1 to 2 inches in thickness shooting from it east and west, and varying in length from 1 to 2 feet. The interstices are filled with sand and trap rock, charged with native copper, say 50 to 75 per cent., also small masses of crystallised marcasite or spar, filled with what has the appearance of copper filings, being quite rich. This is what is called the copper rock—as unlike a rock as possible. It looks more like a large tree that had fallen and turned to metal, with this exception, that its depth is not in proportion. Large detached masses of native copper, weighing from 50 lbs. to 300 lbs., are taken from alongside of this sheet; and the vein stone up to the wall rock is richly charged with copper in its native state."

ITALIAN SCIENTIFIC CONGRESS.

Whilst we have been busy in chronicling the proceedings of our own scientific association, the Italians have not been idle. They, too, have had theirs, and Genoa was the appointed place of reunion. Italy—despite all its factions, its turbulent politics, and the too frequent illiberality of some of its governments—has always stood high in scientific repute, and we doubt not that the enlightened policy of the new Pope will afford a strong impetus to the prosecution of those studies which it is the aim of the Scientific Congress to foster and support. We have no room to offer a detailed account of the various papers which came under the notice of the present assembly; indeed, the subjects of most of them are foreign to our purposes. We may mention, however, that, in the agricultural section, Signor Ratti read a memoir on the all-absorbing topic of the potato disease, and detailed some experiments which he had made relative to the subject, without, however, arriving at any satisfactory conclusions.

In the zoological section, Signor A. Costa read a memoir on the pretended poisonous qualities of wounds inflicted by the spines of the trachini, in which it was asserted that the wounds were inflicted by the spine of the first dorsal fin, and the inflammation was merely due to the mechanical structure of the instrument of puncture. The Neapolitan Congress had leaned towards a contrary opinion.

Professor Mayer, of Bonn, gave an account of the effects of the galvanic current on the heart's motion. The result of his experiments was, that the current, so long as it lasted, arrested the heart's pulsation, which returned when the current was withdrawn.

In the electrical section, Signor Majocchi communicated a memoir to prove that two forces were necessary for the generation of the electrical current, and that the electrical effects of the galvanic current depended *not* upon chemical action, but upon what he termed the electro-motive force.

In the section on caloric, Professor Codazza made some observations, the object of which was to apply the theory of undulations to explain various phenomena of heat.

In the geological and mineralogical section, General Marmora communicated some observations relative to a red dust which had fallen from the heavens in May last, at Genoa, Tunis, Sardinia, Corsica, and Pisa.

Signor Maltedo communicated the result of an analysis of this substance collected at Genoa, from which it was demonstated to contain animal matter, iodine, bromine, carbonates of lime and iron, alumina, and a trace of silica.

ON SPECIFIC GRAVITIES.

BY J. HORSLEY, ESQ.

The ordinary mode of taking the specific gravity of fluids by means of the thousand-grain bottle has been found inconveniently large at times, as well as the use of it for acids very awkward.

Whenever I wish to ascertain the specific gravity of any smaller quantity, say 100 grains, I make use of an upright, accurately graduated minim measure, take its counterpoise, and fill it exactly to 95 minims, which is the measure or bulk of 100 grains of distilled water as unity, note the density of the fluid to be examined, and compare accordingly. Suppose the weight of sulphuric acid is to be taken, all one has to do is simply to measure out 95 minims, place the counterpoise of the measure in one pan, and the fluid in the opposite. The difference of weight compared with unity gives the specific gravity with very little trouble and tolerable accuracy.

PHARMACEUTICAL SOCIETY.

On Wednesday, the 7th October, the first Conversazione for the season, of the Pharmaceutical Society was held at the Society's rooms in Bloomsbury-square. The evening passed off pleasantly, and these re-unions will, no doubt, be the source of much friendly intercourse during the winter season.

TO CORRESPONDENTS.

"C. W." (Liverpool) is assured that *The Chemist* has always been, and continues to be, regularly published on the usual "magazine day;" the irregularity of which he complains is, therefore, the fault of his London agent, and not of our publisher.

"H. B." (Burton-upon-Trent), "A. H." (Manchester)—A few *complete sets* of *The Chemist* may be had at the published prices. The first four volumes *cannot* be had separately.

"W. S.," and other inquirers, are informed that the "Chemical Nomenclature and Classification, by F. Hoefer," now in course of publication in our journal, will be published in a separate form as soon as completed.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month, Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

CHEMICAL NOMENCLATURE AND CLASSIFICATION; TO WHICH IS ADDED, AN HISTORICAL LEXICON OF SYNONYMES, INCLUDING THE ANCIENT NAMES, THE FORMULÆ, THE NEW NAMES, THE NAMES OF THE AUTHORS, AND THE DATE OF THE DISCOVERY OF THE PRINCIPAL PRODUCTS OF CHEMISTRY.

(*Continued from page* 489.)

BY FERD. HOEFER, DOCTOR IN MEDICINE.

Caloric, light, or electricity, constantly destroy the equilibrium of the molecules of natural bodies, and produce the phenomena of life and death. Caloric determines, at the same time, both the union of different molecules, and the separation of compound molecules. Forming in one direction, and decomposing in another. The chemist cannot decompose a complete body, except under the condition of forming other bodies; he destroys, only on condition of reproducing. When he reduces the rust of iron by means of charcoal, it is only under the condition of giving birth to a compound of oxygen and carbon, to carbonic acid, or oxide of carbon, and it is not in the chemist's power to act otherwise.

Bodies combine with each other in definite and constant proportions. Thus, 100 parts of oxygen, by weight, require exactly 1,294 parts of lead, by weight, to form a compound called protoxide of lead. The same quantity of lead combines with 201·165 of sulphur to form a sulphuret of lead. The quantities, by weight, 100 parts of oxygen to 1,294 parts of lead, or 201·165 sulphur, 442·650 chlorine, &c., are called *equivalent* quantities; and when, in any given compound, the quantity of oxygen it contains is represented by 100, the quantity of sulphur will be represented by 201·165, that of chlorine by 442·650, &c.; in other terms, all these quantities may be substituted for each other—they are *equivalent*. What we have just said of oxygen, lead, sulphur, chlorine, &c., is applicable to all bodies capable of forming compound bodies. We usually employ, as a term of comparison, 100 for oxygen, because this gas enters into a great number of compounds. It is evident that the relative quantities that combine will remain absolutely the same whether we take the weight of the compound itself for unity, or that of one of the elements of the compound. So that in reality it signifies not whether we say that 100 parts of oxygen combine with 12·48 of hydrogen to form water, or that 100 parts of water result from the combination of 88·91 parts of oxygen, with 11·09 parts of hydrogen; for 100 : 12·48 : : 8·91=11·09, the proportions of the quantities are therefore unchanged.

The equivalents are expressed by the initial letter of the name of the element. Thus O signifies 100 parts of oxygen, H, 12·48 hydrogen, and HO, the compound, water, resulting from the combination of these quantities of oxygen and hydrogen. In this manner it is easy to calculate the equivalent of an element when we have previously ascertained, by analysis, the quantity, by weight, of that element entering into the given compound. Do we wish, for instance, to ascertain the equivalent of sulphur? We must first remember that sulphur forms, with oxygen, a compound, hyposulphurous acid, which, in 100 parts, contains—

Sulphur..	66·80
Oxygen..	32·20
	100·00

Now, by establishing the proportion, 33·20 : 66·80 : : 100 = x, we find the value of x = 201·165, a number which is the equivalent of sulphur, S, that of oxygen being 100. Thus we have—

O = 100,
H = 12·48,
S = 201·165.

We proceed, in the same manner, to discover the equivalents of all other simple bodies; but the law of equivalents is applicable, not only to simple bodies that combine with each other, but also with acid and basic compounds, which reciprocally saturate each other. In this manner 100 parts of sulphuric acid, to be perfectly neutralised, require—

118 parts of potash, or
78 parts of soda, or
43 parts of ammonia.

These numbers show the relative power of saturation of potash, soda and ammonia, whatever acid may neutralise the bases. They preserve the same relative proportions between themselves. Therefore, when we know the relative quantity or power of saturation of these bases, we shall know that of others. Thus, for instance, if 100 parts of hydrochloric acid saturate 63 parts of ammonia, it will require 173 parts of potash, or 100 parts of soda to saturate the same quantity of hydrochloric acid; because $43 = 118 : 78 :: 63 : 173 = 114$ in round numbers; in other words, 43 parts of ammonia are equivalent to 118 parts of potash, or (and this makes no change in the proportion) 63 parts of ammonia are equivalent to 173 parts of potash, or 114 parts of soda.

Equivalents have nothing in common with hypotheses, they are real results, obtained by experiment, and the direct employment of the balance, without pretending to any theoretical explanation of the molecular constitution of bodies. This it is that distinguishes equivalents from the atomic theory.

In the following lexicon we have employed formulæ expressing equivalents. In most cases, the equivalents express the same quantities as the atoms; but there are cases in which the equivalent expresses a double atom. Thus, by employing equivalents for the formula of oxide of ammonium we write $\dot{N}\,H^4\,O$; and when employing atoms $N^2\,H^8\,O$.

Formula constitute a kind of algebraic language. Every formula is called *rational* which by a certain arrangement of signs or letters, expressing atoms or equivalents, has a tendency to show the manner in which the elements are combined with each other, while the *crude* or *empirical* formula simply indicates the quantities of the elements that enter into a compound, without estimating, in any manner, their molecular grouping. From this it follows, that no formula whatever ever has more than a single crude or empirical formula; but it may have an infinite number of rational formulæ, according to the particular views or theories of each chemist.

For example, the empirical formula of alcohol is $C^4\,H^6\,O^2$; but at least seven different rational formulæ have been proposed, thus M. Dumas represents alcohol by $C^4\,H^8 + H^4\,O^2$, and by $C^2\,H^8 + C^2\,H^4\,O^2$; M. Berzelius by $(C^2\,H^8)\,O$; M. Liebig by $(C^4\,H^{10})\,O + H^2\,O$; Messrs. Zeise and Mitscherlich by $C^4\,H^{10}\,O^2 + H^2$; M. Malaguti by $C^4\,H^6\,O + H^4 + H^2\,O$; M. Persoz by $C^2\,(H^{12}\,C^2\,O^2)^{16}$.

Rational formulæ, in organic chemistry, have been greatly increased in number since the invention of radicals. Accordingly, those who admit the hypothetical existence of a radical called ethyle, represented either by $C^4\,H^5\,O = \dot{A}e\,O$ (*oxide of ethyle*). In the case of the partisans of hypothetical radicals, olefiant gas (*bicarbonated hydrogen*) is a hydruret of acetyle, $C^4\,H^3 + H = Ae + H$; sulphoamylic acid is a bisulphate of oxide of amyle, $C^{10}\,H^{11} + O$, $2SO^3 = Ayl\,O$, $2SO^3$.

In mineral chemistry there is less latitude for rational formulæ. Salts are, nevertheless, always represented by rational formulæ. Thus, we write SO^3, KO, sulphate of potash; $Ph\,O^5$, $Na\,O$, phosphate of soda; NO^5, $Ag\,O$, nitrate of silver; instead of writing SKO^4, $Ph\,Na\,O^6$, $NAg\,O^6$, empirical formulæ, the plain and simple expression of the elements of the compound bodies, without giving any idea of their grouping. The usual notation of compound bodies in mineral chemistry is founded on dualism, established, in the first instance, by the nomenclature, and afterwards formulated according to the electro-chemical theory. It would be also extremely difficult, if not impossible, to adopt empirical formulæ to represent the real composition of salts, as M. Baudrimont has proposed. *Usus est tyrannus.* Custom will always cause us to write KO, SO^3, sulphate of potash, &c., which, when submitted to the action of the pile, is decomposed into sulphuric acid, SO^3, and into potash, KO, as the rational formula shows, and not into sulphur, S, potassium, K, and oxygen, O^4, as the empirical formula expresses it.

May I be allowed to make an observation on the subject of rational formulæ, which has the highest degree of interest with regard to the philosophy of science? Chemists, more than any other *savans*, treat with profound disdain everything that has a connection with the rational element in the speculative theories of science. Experience, according to them, is the only torch by which the progress of their researches can be lighted. But it is a very foolish assumption, and one impossible to be realised, to refuse to admit a fact which the eye sees and the hand feels, as being scientifically true. When the chemist analyses a substance, he does not alone content himself by enumerating and weigh-

ing the elements he discovers, he is forced, as if by an irresistible necessity, to group them, and to arrange them in the order that appears in his mind to be the best. Such is the philosophical value of rational formulæ. They supply a necessity that is not to be overcome, and which is inherent in the very essence of our intellectual organisation.

A LEXICON OF THE SYNONYMES AND A HISTORY OF SIMPLE AND COMPOUND BODIES THAT HAVE BEEN DISCOVERED UP TO THE PRESENT TIME.

Present Names.	Formulæ.	Synonymes and Old Names.	When discovered, and by whom.
Albietine	Ill defined	.. ..	Caillot, 1825 (?).
Acéchlorplatine	Pt Cl + C^6 H^5 O [C^6 H^5 Pb Cl^2]*	Chloroplatinate of oxide of mesityle (Liebig)	Zeise, 1839.
Acetate of alumina	Al^2 O^3, 3 A	Acetate of clay—acetous salt of clay.	
,, of amiline	C^{20} H^{22} O, A	.. ..	Cahours, 1840.
,, of ammonia	N H^4 O, A	Acetous salt of ammonia—Minderer's spirit.	
,, of antimony	Sb^2 O^3, 3 A	Acetate of emetic tartar.	
,, of baryta	Ba O, A; Ba O, A; —crystallised.	Acetous salt of *terra ponderosa.*	
,, of bismuth	Bi O, A	Sugar of bismuth	Geoffroy.
,, of cadmium	Cd O, A		
,, of peroxide of cerium	Ce^2 O^3, 3A	Ceric acetate	Berzelius.
,, of chrome	Cr O^3, 3A	Cerous acetate	Berzelius.
,, of cobalt	Co O, A		
,, of copper	Cu O, A; CuO,A,HO; crys. [Cu O, (C^4 H^3 O^3) + HO]	Cupric acetate (Berz.); *Verdet;* crystals of Venus.	
,, of protoxide of copper	Cu^2 O, A	Cupreous acetate	Berzelius.
,, of glucinum	G^2 O^3, 3 A		
,, of peroxide of iron	Fe^2 O^3, 3 A	Ferric acetate	Berzelius.
,, of protoxide of iron	Fe O, A	Ferrous acetate (Berz.) acetous martial salt.	
,, (neutral) of lead	Pb O, A	Plumbic acetate (Berz.), sugar of Saturn; salt of Saturn; sugar of lead.	
,, (neutral) tribasic	3 Pb O, A	Triplumbic acetate (Berz.)	
,, (neutral) sexbasic	6 Pb O, A	Sexplumbic acetate (Berz.)	
,, of lime	Ca O, A	Salt of coral (Hartmann), acetous calcarious salt.	
,, of littria	L O, A		
,, of magnesia	Mg O, A		
,, of peroxide of mercury	Hg O, A	Hydrargyric acetate; foliated mercurial earth (Berz).	
,, of protoxide of mercury	Hg^2 O, A	Hydrargyrous acetate (Berz).	

* The symbols and numbers between brackets, thus [ ], are on the authority of Graham.

Present Names.	Formulæ.	Synonymes and Old Names.	When discovered, and by whom.
Acetate of peroxide of molybdenum	Mo O^3, 2 A	Molybdic acetate (Berz).	
,, of protoxide of molybdenum	Mo O, A	Molybdous acetate (Berz).	
,, of nickel	Ni O, A		
,, of palladium	Pd O, A		
,, of platinum	Pt O, A		
,, of potassium	K O, A	Kalic acetate (Berz.), foliated earth of tartar.	
,, of rhodium	R^2 O^3, 3 A		
,, of silver	Ag O, A		
,, of sodium	Na O, A		
,, of protoxide of tin	Sn O^4, A	Stannous acetate (Berz).	
,, of uranium	U^2 O^3, 3 A	Mineral foliated earth; acetous mineral salt.	
,, of zinc	Zn O, A	Acetous salt of zinc.	
Acetone	C^3 H^3 O	Pyroacetic spirit; pyroligneous spirit.	
Acid—			
Abietic	Not determined	.. ..	Baup, 1825.
Acetic	A = C^4 O^3 H^3	Radical vinegar, spirit of Venus, acetous acid, oxyacetic acid (Brugnatelli).	
Aconitic	C^8 H^4 O^8 [H O + C^4 H^3 O^3]	Equisetic acid (Regnault). Citric acid (Baup)	Peschier in *Aconitum napellus*.
Acrylic	C^6 H^4 O^4	.. ..	Redtenbacher.
Aldehic	C^4 H^4 O^2	Lampic acid	Davy & Farraday.
Allantoic	C^4 H^3 N^2 O^3	Allantoin amniotic acid	Vauquelin & Buniva.
Aloeretinic	Not determined		
Aloetic	Not determined	.. ..	Schunck.
Ambreic	Not determined	.. ..	Pelletier & Caventou.
Ampelic	C^{14} H^6 O^6	.. ..	Laurent, 1841.
Amygdalic	C^{40} H^{26} O^{24}	.. ..	Woehler & Liebig, 1836.
Anilic	C^{28} NH^5 O^{10}	Indigotic acid	Buff.
Anisic	C^2 H^7 O^6, crystld.	.. ..	Cahours, 1840.
Antimonious	Sb^2 O^4 [Sb O^4]		
Antimonic	Sb^2 O^5 [Sb O^5]		
Apocrenic	C^{14} H^7		
Arsenious	As^2 O^3 [As O^3]	White arsenic; arsenic	Known to the Ancients.
Arseniovinic	As(?) O^3, 2 Ac	Arseniate of oxide of ethyl	Dareet.
Arsenic	As^2 O^5 [As O^5]		
Aspartic	C^8 NH^5 O^6	Asparamic acid.	
Azoleic	C^{18} H^{26} O^4		
Azotous (nitrous)	N O	Hypoazotous; hyponitrous.	
Azotic (nitric)	N O	Aquafortis	Geber, in 19th century.
Benzilic	C^{28} H^{11} O^5 + H O	.. ..	Liebig.
Benzoic	C^{14} H^5 O^3, H O; (symbol Bz O)	Flowers of Benjamin	Blaise de Vigenere, 16th century.
Benzoretic	Not determined	.. ..	Kopp.
Benzosulphuric	C^{12} H^{10} S^2 O^5 + H O	Sulphobenzidic, sulphobenzilic, hyposulphobenzidic acids.	Mitscherlich.

Present Names.	Formulæ.	Synonymes and Old Names.	When discovered, and by whom.
Acid—			
Bibromisatinic	$C^{32}\ H^5\ Az\ Br^3\ O^4 + H\ O$	.. ..	Erdmann.
Bichlorisatinic	$C^{32}\ H^5\ Az\ Cl^2\ O^4, H\ O$	.. ..	Erdmann.
Bilifellic	Not determined	.. ..	Berzelius.
Boric	$B\ O^3$ [H O, $BO^3 + 2\ H\ O$]	.. ..	F. Hoefer, 1777.
Bromic	$Br\ O^5$	.. ..	Balard, 1826.
Bromisatinasic	$C^{30}\ H^5\ Br\ Az\ O^6$	.. ..	Laurent.
Bromisatinesic	$C^{32}\ H^4\ Br\ Az\ O^6$	.. ..	Laurent.
Bromobenzoic	$C^{28}\ H^9\ Br\ O^8 + 2\ H\ O$	.. ..	Péligot.
Bromodraconesic	$C^{64}\ H^{14}\ O^{12}\ Br^2$	.. ..	Laurent.
Bromophenisic	$C^{12}H^2rB^3O^3 + HO$	.. ..	Laurent, 1842.
Bromosalicylic	$C^{28}\ (H^5\ Br)\ O^6$		
(brown) of nitro-naphtate	Not determined		
Brunolic	Not determined	.. ..	Runge.
Butyric	$C^8\ H^7\ O^3\ H\ O$ [HO, $C^8\ H^7O^3$]	.. ..	Chevreul.
Butyroelic	$C^{68}\ H^{30}\ O^4 + H\ O$	.. ..	Bromeis, 1842.
Cafeic	Not determined	.. ..	Runge.
Cafetannic	Not determined	.. ..	Runge.
Campholic	$C^{20}\ H^{34}\ O^3$		
Camphoric	$C^{10}\ H^7\ O^3 = Ca$	.. ..	Kosegarten.
Capric	$C^{20}\ H^{19}\ O^3$ [H O + $C^{18}\ H^{14}\ O^3$]	.. ..	Chevreul, 1821.
Caproic	$C^{12}\ H^{11}\ O^3$ [H O + $C^{12}\ H^9\ O^3$]		
Caprylic	$C^{16}\ H^{15}\ O^3$		
Carazotic	$C^{28}N^3\ H^3\ O^{15}$ [HO + $C^{12}\ H^2\ N^3\ O^{12}$]	Indigo bitter; Welter's bitter, picric acid	Liebig, 1827.
Carbolic	$C^{12}\ H^4\ O$, H O	Hydrate of phenyl	Runge.
Carbomethylic	$C^4\ H^6\ O$, $C^2\ O^2$		
Carbonic	$C\ O^2$	Gas of the woods (Van Helmont); aerian acid (Berg.); fixed air (Black); acid of chalk	Bergmann & Black.
Carbovinic	$C^8\ H^5\ O$, $C^2\ O^2$		
Caseic	Not determined	Acetate of aposepedine (Braconot.)	Proust.
Ceraic	Not determined	Ceric acid	Hess, 1841.
Ceradic	Not determined	.. ..	Pelletier and Caventou.
Chlophtalisic	$C^{32}\ H\ Cl^2\ O^6$	.. ..	Laurent, 1843.
Chloracetic	$C^4\ Cl^3\ O^3 + H\ O$	Chlorated acetic acid	Dumas.
Chloronaphtisic	$C^{40}\ H^5\ Cl\ O^6$	Chloronaphthalic acid	Laurent, 1843.
Chloranilic	$C^{12}ClO^3$ [C^6ClO^3]	.. ..	L. Erdmann, 1841.
Chlorous	$Cl\ O^3$	.. ..	M. Millon, 1843.
Chlorindoptic	$C^{24}\ H^3\ Cl^3\ O$	.. ..	L. Erdmann, 1840.
Chloric	$Cl\ O^5$	Chlorous acid; superoxigenated muriatic acid	Berthollet.
Chlorisatinic	$C^{32}\ H^5\ N\ Cl\ O^4$	.. ..	Erdmann, 1841.
Chlorisatinasic	$C^{32}\ H^5\ Cl\ N^4$	.. ..	Erdmann, 1841.
Chlorosatinesic	$C^{32}\ H^5\ Cl^2\ N\ O^4$	.. ..	Erdmann, 1841.
Chlorocarbonic	$2\ (C^2\ O)\ Cl$	Chloroxicarbonic acid; chloride of oxide of carbon	H. Davy.

Present Names.	Formula.	Synonymes and old Names.	When discovered and by whom.
Acid—			
Chlorochloric	$Cl^3 O^{12}$	.. ..	Millon, 1843.
Chlorodraconesic	$C^{64} H^{14} O^{12} Cl^2$	.. ..	Laurent, 1842.
Chloronaphthalic	$C^{16} H^3 O^4$	.. ..	Laurent, 1840.
Chloropercbloric	$Cl^3 O^{17}$	.. ..	Millon, 1843.
Chlorophenisic	$C^{24} H^2 Cl^3 O$	.. ..	Laurent, 1841.
Chlorophenesic	$C^{24} H^5 Cl^2 O^2$	.. ..	Laurent, 1841.
Chloroxalic	$C^4 O^3 H Cl$	.. ..	Dumas, 1830.
Chloroxénaph. thalesic	$C^{40} H Cl^5 O^6$	.. ..	Laurent, 1843.
Cholanic	Not determined	.. ..	Berzelius.
Cholesteric	Not determined	.. ..	Pelletier and Caventou.
Cholic	Not determined	.. ..	L. Gmelin.
Chromic	$Cr O^3$	.. ..	Vauquelin.
Chrysammic	$C^{30} H^2 N^2 O^{13}$	.. ..	Schunck.
Chrysolepic	$C^{24} H^3 N^3 O^{14}$	.. ..	Schunck, 1841.
Cinnamic	$C^{18} H^7 O^3 + HO = Ci O + HO$		
Citraconic	$C^5 H^2 O^3$		
Citric	$Ci = C^{12} H^5 O^{11}$	Lemon acid (*acide citronien*)	Scheele, 1784.
Cocognidic	Not determined		
Cocostearic	$C^{27} H^{26} O^3$		
Coumaric	$C^{18} H^7 O^5 H O$		
Crenic	$C^7 H^{16} N O^6$	Mineral water extract	Berzelius.
Croconic	$C^5 O^4$	.. ..	Gmelin.
Crotonic	Not determined	Iatrophic acid	Pelletier&Caventou
Cuminic	$C^{20} H^{11} O^3$	.. ..	Gerhardt, Cahours.
Cyanic	$Cy O = C^2 N O$	.. ..	Woehler.
Cyanuric	$Cn = C^6 N^6 O^3$, 3 H O [3 HO, $Cy^3 O^3$]	.. ..	Scheele.
Cyanilic	$C^6 N^3 H^3 O^6$	Distilled acid of urine (Scheele) Cyanic acid of Serullas.	
Delphinic	$C^{10} H^7 O^3$	Phocenic acid	Chevreul.
Dialuric	Not isolated		
Draconic	$C^{32} H^{13} O^5 + 2 HO$	.. ..	Laurent, 1842.
Elaidic	$C^{72} H^{66} O^5$		
Ellagic	$C^7 H^3 O^5$	.. ..	Chevreul.
Erythroleic	$C^{52} H^{11} O^8$ [$C^{26} H^{22} O^8$]	.. ..	Kane, 1841.
Esculic	$C^{52} H^{23} O^8$	.. ..	Ed. Fremy, 1834.
Ethalic	$C^{32} H^{31} O^3$	.. ..	Dumas and Stas.
Etherosulphuric	2 S O^3 + Ae O [E O, S O^3 + H O, S O^3]	Cetylic acid; sulphate of acid of oxide of ethyl; sulphovenic acid	
Ethionic	$C^8 H^4$, 4S O^3, 2HO	.. .. ..	Woehler.
Euchroic	$C^{12} N Az^4 O^4$	.. ..	Bonastre.
Eugenic	Not determined		
Fellic	Not determined	.. .. ..	Berzelius.
Ferric	$Fe O^3$	.. .. ..	Fremy, 1842.
Fluoboric	F H + 3 B F		
Fluosilicic	F H + 2 Si F	Fluoride of silicium; pthoride of silicium; pthorosilicic acid	Scheele, 1771.
Formic	$H^2 C^2 O^3$ [HO + C^2 $HO^3 = HO, FoO^2$]	.. ..	Echlen.
Formo benzoilic	C^2 H O^3 + $C^{14} H^5$ O^2 + HO [HO + Bz H, C^2 H O^3]	.. ..	Winkler.

Present Names.	Formulæ.	Synonymes and old Names.	When discovered and by whom.
Acid—			
Fulminic	Cy O = C^4 N^4 O^2 [C^4 N^2 O^2 = Cy^2 O^2]	.. ..	Gay-Lussac and Liebig.
Fumaric	C^4 H O^3 + 2 HO [H O + C^4 H O^3]	.. ..	Winkler.
Fungic	Not determined	Acid of mushrooms	Braconnot.
Gallic	G = H^6 C^7 O^5 [2 H O, C^7, H O^3 + H O]	Essential salt of gall-nuts. The astringent principle	Scheele.
Glucic	C^{24} H^{15} O^{15}	.. .. ..	Peligot.
Hippuric	$C^{18}H^8$ N, O^5 + HO	.. ..	Liebig.
Hircic	Not determined	.. ..	Chevreul.
Humic	C^{40} H^{12} O^{12}		
Hydrindinic	C^{32} H^{15} N^2 $O^{\frac{1}{2}}$ (?)	.. ..	Laurent, 1841.
Hydriodic	I H	.. ..	Gay-Lussac, 1814.
Hydrochloric	Cl^3 O^{12} [H + C^7]	.. ..	Millon, 1843.
Hydrochlorocyanic	C^2 N^2 Cl^5 H^2	.. ..	Gay-Lussac & Liebig.
Hydroferrocyanic	C^6 N^6 Fe H	Ferrarated prussic acid	Porrett.
Hydrofluoric	Fl H	Fluoric acid; spathic acid hydrophthoric acid	Scheele, 1771.
Hydromargaric	Symbol H Mr + 2 HO		
Hydrosulphocyanic	Cy^2 S^2 H		Rink.
Hydrosulphuric	S H	Sulphuretted hydrogen.	
Hydrothiocyanic	S^{12} C^{10} N^5 H^6 O^2	.. ..	Parnell.
Hypochlorous	Cl O	.. ..	Balard, 1815.
Hypoiodic	Not determined	.. ..	Millon, 1844.
Hypophosphorous	Ph^2 $O^{3\frac{1}{2}}$ [2 P + 2 O, or 3 P + 3 O, instead of PO] (?)	.. ..	Dulong.
Hypochloric	Not determined	.. ..	H. Davy, 1809.
Hypopiorotoxic	C^{11} H^{13} O^4	.. ..	Pelletier & Courbe, 1833.
Hyposulphoglutic	Not determined	.. ..	Pelletier & Courbe, 1833.
Hyposulphonaphthic	C^{22} H^9 + S^2 O^6	.. ..	Berzelius.
Hyposulphurous	S^2 O^2, or [SO^2 + S]	Sulphosulphuric acid	Gay-Lussac.
Hyposulphuric	S^2 O^5	.. ..	Gay-Lussac.
Imasatic	C^{32} H^{13} N^3 O^4	.. ..	Laurent, 1841.
Indigotic	$C^8H^4NO^3$ + 3HO^2		
Indinic	C^{32} H^7 NO^3	.. ..	Erdmann and Laurent, 1841.
Iodic	IO^5	Iodous acid	Gay-Lussac, 1814.
Isatic	C^{16} N H^7 O^5, HO	.. ..	Erdmann&Laurent.
Isatinic	C^{32} H^6 Az O^5	.. ..	Erdmann and Laurent.
Isethionic	S^2 O^5, C^4 H^5 O^2 + HO	.. ..	Magnus.
Itaconic	C^5 H^2 O^3, HO = It + HO [HO + C^5 H^2 O^3]	Pyrocitric acid.	
Japonic	C^{12} L^4 O^4 + HO	.. ..	Svanberg.
Jatrophic	Not determined	Crotonic acid.	Pelletier and Caventou, 1818.

Present Names.	Formulæ.	Synonymes and Old Names.	When discovered, and by whom.
Acid—			
Kahincic	Not determined	.. ..	Pelletier&Caventou
Kaliacetic	Not determined	.. ..	Melseus, 1842.
Kinic	$C^{16} H^{12} O^{12}$ [$C^7 H^6 O^6$, or $C^{14} H^{12} O^{12} = HO + C^{14} H^{11} O^{11}$]	Quinic acid	Hoffmann, 1790.
Kinovic	Not determined	.. ..	Pelletier&Caventou
Krameric	Not determined	.. ..	Peschier.
Laccic	Not determined	.. ..	John.
Lactic	$C^6 H^6 O^6$, symbol = L	.. ..	Scheele.
Lactucic	Not determined	.. ..	Pfaff.
Lampic	$C^4 H^3 O^2 + HO$	Aldehidic acid; acetous acid	Davy and Faraday.
Laurostearic	$C^{36} H^{36} O^3$	.. ..	Maison, 1842.
Lichenic	Not determined	.. ..	Pfaff.
Lipic	$C^5 H^4 O^5$	.. ..	Laurent.
Lithofellic	$C^{40} H^{36} O^7 + HO$	Bezoar acid	Goebel.
Maleic	$C^8 H^2 O^6$=Ma	.. ..	Pélouze.
Malic	$C^8 H^4 O^8$ [$2HO + C^8 H^4 O^6$]	Apple acid	Scheele.
Manganous	Mn O^3	Manganesous acid.	
Manganic	$Mn^2 O^7$	Manganesic acid	Scheele.
Margaric	Mr = $H^{67} C^{68} O^3$ [$2HO\ C^{68} H^{66} H^{66} O^6 = 2HO + 2(C^{34} H^{33} + O^3)$]	Margarylic acid	Chevreul.
Mechloic	Not determined		
Meconic	$C^{14} HO^{11}$ [$3HO, C^{14} HO^{11} + 6HO$]	.. ..	Piria.
Melanic	$C^{10} H^4 O^5$		
Melarsic	$C^{24} H^{12} O^{10}$ (Dumas)		
Mellitic	$C^4 O^3$ [$H, C^4 O^4$ or $HO + C^4 O^3$]	.. ..	Klaproth.
Metalgallic	$C^6 H^2 O^2$	Melangallic acid (Berz.)	Pelouze.
Metapectic	Not determined.	.. ..	Fremy.
Metaphosphoric	$Ph^2 O^5$ HO	.. ..	Graham.
Metastannic	$Sn^3 O^6$, 3HO	.. ..	Fremy, 1842.
Molybdous	MO O^2	Binoxide of molybdenum	
Molybdic	MO O^3	.. ..	Scheele, 1782.
Mucic	$C^{12} H^8 O^7 + 2HO = M$ [$C^{12} H^8 O^{14} + 2H O$]	.. ..	Scheele.
Myristic	$C^{56} H^{28} O^4$	.. ..	Playfair, 1841.
Naphthalic	$C^{20} H^2 O^4$ [$HO + C^8 H^2 O^3$]	.. ..	Laurent, 1840.
Nitroanisic	$C^{32} H^6 (NO^4) O^5$	.. ..	Cahours, 1840.
Nitrobenzoic	$C^{28} H^5 (NO^4) O^4$, (Mulder)	.. ..	Plantamour, 1840.
Nitrobromodraconesic	$C^{64} H^{12} Br (NO^4) O^{10} + 2HO$	.. ..	Laurent, 1842.
Nitrobromophenisic	$C^{12} H^{12} Cl^2 (NO^4) O^{10} + HO$	.. ..	Laurent, 1842.
Nitrochlorodraconesic	$C^{64} H^{12} Cl^2 (NO^4) O^{10} + 2HO$	.. ..	Laurent, 1842.
Nitrocinnamic	$C^{36} H^{17} (NO^4) O^4$	.. ..	Mitscherlich, 1841.

(*To be continued.*)

ON THE ACTION OF PROTOCHLORIDE OF TIN AND OF METALLIC TIN UPON SULPHUROUS ACID.*

BY H. WACKENRODER.

The method described by Pelletier, sen., and subsequently by Girardin, Fordos and Gelis, for detecting small quantities of sulphurous acid by means of protochloride of tin, and which has quite recently been strongly recommended by Heintz in a modified form, appeared to me worthy of attention; since, with the exception of sulphuretted hydrogen, there is no other ready and sufficiently sensitive reagent for sulphurous acid in all those cases in which there is at the same time a large amount of muriatic acid present, or where the other reagents for sulphurous acid cannot be employed. This applies especially to the examination of muriatic acid for sulphurous acid, which, at present, occurs very frequently in the muriatic acid of commerce.

Sulphuretted hydrogen indicates, it is true, extremely minute quantities of sulphurous acid in the muriatic acid, by the production of a white turbidness; but the reduction of the sulphur may also be caused by other substances, as, for instance, by chlorine and perchloride of iron, and likewise in a slight degree, by the oxygen of the air, so that other tests must be employed to decide with certainty as to the presence of sulphurous acid. Moreover, sulphuretted hydrogen produces, with sulphurous acid, a new acid of sulphur, which I shall describe in a future paper under the name of pentathionic acid. This new acid, which is represented by the formula $S^5 O^5$, is not decomposed by sulphuretted hydrogen; and it is precisely its production which renders the purification of the crude muriatic acid, contaminated with arsenic and sulphurous acid, far more difficult than it apparently is.

It was immediately evident, however, that the mode proposed by M. Heintz for producing the reaction could not ensure any great accuracy. The muriatic acid, to which protochloride of tin has been added, and the whole heated, when it does not yield the yellow precipitate of persulphuret of tin, is to be merely treated with sulphate of copper for the production of sulphuret of copper. But taking into consideration the reactions of sulphuretted hydrogen towards metallic oxides, it is evident that, as recently-precipitated sulphuret of tin is very readily soluble in strong muriatic acid, no yellow precipitate can be produced when a tolerable excess of muriatic acid is present, even when the liquid is concentrated and heated. As the sulphuret of copper is less easily dissolved by strong muriatic acid than the persulphuret of tin, the sulphide of copper is capable of demonstrating the presence of the sulphuretted hydrogen produced, where neither persulphuret of tin, and much less protosulphuret, can be formed in acid liquids; however, the sulphuret of copper is also not wholly insoluble in concentrated muriatic acid.

Now it is readily seen that in this reaction every thing depends on the production of the sulphuretted hydrogen. When this is formed in large quantity, persulphuret of tin may be produced; but in every case, and even when only present in the most minute quantity, it will gradually escape from the acid liquid, and then, although not perceptible to the smell on account of the muriatic acid vapours, may readily be detected in another manner. It is upon this that is based the modification which I have made in the process recommended by Heintz.

The muriatic acid to be tested for sulphurous acid is simply treated with a tolerable quantity of the ordinary protochloride of tin in a test-glass. When other liquids are to be examined which do not contain any free muriatic acid, they must be previously mixed with a tolerable quantity of pure muriatic acid. In examining hydrated sulphuric acid, a couple of drops of water or muriatic acid should be added, in order that the liquid may not thicken. Immediately on the addition of protochloride of tin, the glass is covered with a plate of glass, under which is placed a piece of thick white blotting-paper, which has been moistened with a strong solution of acetate of lead. According to the quantity of the sulphuretted hydrogen disengaged from the sulphurous acid does the lead-paper become more quickly, and in a greater or less degree, black. Extremely minute traces of sulphurous acid require half-an-hour or more to produce a slight blackening or browning of the lead-paper, which is best perceived by removing the glass plate with the paper, and holding it to the light. When the muriatic acid fumes strongly, a considerable quantity of chloride of lead is formed at the same time on the paper; it is, therefore, advisable to dilute the acid with some water, when the small quantity of chloride of lead formed does not interfere with the reaction. Sulphate of copper does not answer so well as acetate of lead.

This test is as simple as it is accurate and sensitive; it is far more evident than the turbidness produced by sulphuretted hydro-

* *Pharm. Cent. Blatt.*, Sept. 5, 1846, and *Chemical Gazette.*

gen and sulphurous acid when mixed with muriatic acid. It is decidedly preferable to this latter test, as it proves the presence of the sulphur in the sulphurous acid. However, pentathionic acid likewise disengages sulphuretted hydrogen under the same circumstances; and, consequently, all the other acids of sulphur, with the exception of sulphuric, will do the same.

Various views may be entertained respecting the production of the sulphuretted hydrogen from the sulphurous acid by protochloride of tin, especially in the presence of an excess of strong muriatic acid. Heintz's opinion, that $2SO^2$ are decomposed by 6 Sn Cl^2 to form Sn S^2, 2 Sn O^2 and 3 Sn Cl^4 must be so far corrected that only Sn S^2 and 5 Sn Cl^4 can be formed in a acid liquid. It appears to me far more simple and probable to assume that one atom of SO^2 and 1 atom Sn Cl^2 are mutually decomposed, forming Sn S; while the O^2 and Cl^2 are transferred to the excess of Sn Cl^2, and so produce 3 Sn Cl^4. But since the liquid contains an excess of strong muriatic acid, the Sn S is again converted into Sn Cl^2 and H^2 S, which either wholly escapes from the liquid, or depending upon its quantity, may produce the proto or persulphuret of tin, or merely persulphuret of copper in the acid liquid.

It is quite evident, therefore, from what has been above-stated, that metallic tin may be employed instead of the protochloride for the detection of sulphurous acid, when at the same time a sufficient quantity of strong muriatic acid is added to the liquids. Indeed, pure tinfoil appears to indicate still smaller traces of sulphurous acid than the protochloride; it is, however, necessary each time to ascertain whether the tinfoil be pure from sulphur. A moderately dilute muriatic acid mixed with a very little sulphurous acid disengages sulphuretted hydrogen with tinfoil, even at the ordinary temperature, without any bubbles of gas appearing near the metal. The crude fuming muriatic acid, which generally contains much sulphurous acid, dissolves the tinfoil at the ordinary temperature of the air, with a considerable disengagement of gas and diffusion of an extremely fetid odour, which has frequently been erroneously considered to be arseniuretted hydrogen; but this is probably contained in the escaping gases after the sulphurous acid has been entirely destroyed, which does not take place so easily. No separation of persulphuret of tin occurs, at least as long as there is a large excess of acid present.

The best method of testing crude and rectified sulphuric acid for sulphurous acid, consists in mixing it with protochloride of tin and a few drops of water, with the application of the lead-paper above-described. As a very excellent and pure genuine monohydrated sulphuric acid produces upon, or rather in, the lead-paper a stain, which appears blackish by transmitted light, I am induced to think that traces of sulphurous acid occur in most kinds of crude sulphuric acid. Good rectified sulphuric acid leaves the lead-paper, under similar circumstances, perfectly colourless by transmitted light.

I have still to observe, that both kinds of concentrated sulphuric acid, the crude and rectified, disengage not a trace of sulphuretted hydrogen from pure chloride of sodium; but that a concentrated solution of sublimed sal-almoniac mixed with the sulphuric acid sometimes indicates by the lead-paper the liberation of a trace of sulphuretted hydrogen.

EXPERIMENTS ON DIGESTION.

BY M. BOUSSINGAULT.

(*Continued from page* 493).

NINTH EXPERIMENT.

A Duck crammed with Cocoa.—I made several useless attempts to ingest rape or linseed; the grains entered the trachœa, and the ducks died of suffocation; this induced me to employ the seeds of the cocoa; those I made use of contained—

	gr..
Butter, extracted by ether.....	48·4
Legumin and albumen	20·6
Matters soluble in water	13·4
Ligneous and cellulose substances (the shell)	9·6
Water	8·0
	100·0

I did not attempt to discover the theobromine. After proving the presence of legumin and albumen, I calculated these substances by a determination of the nitrogen, (1 gr. ·072 of cocoa yielded—27 cubic centimetres of nitrogen, at the temperature of 50·54 F., the barometer being at 760 millimetres; 1 gr. ·250 of cocoa yielded to ether 0 gr. ·605 of butter).

At ten o'clock in the morning we commenced cramming, and the duck was killed at ten in the evening. During this interval we ingested 50 grammes of the seed: we collected 4 grammes in the crop, weighed, after being dried in a stove; the ejections were of a chocolate colour, and cylindrical, and the liquid portion was very abundant, for the animal had drank nearly a litre of distilled water; it was of a yellowish colour, and had no acid reaction.

The duodenum and the gizzard contained a brown paste, tolerably dry, and acid. The chyme was not of a uniform colour, in some spots it was milky, in others, particularly near the large intestines, it exactly resembled thick chocolate. Throughout the whole length of the intestinal canal it exhibited a slight acid reaction. We obtained—

	Wet. gr.	Dry. gr.	Fat. gr.
From the duodenum, gizzard & intestines..	14·00	3·05	1·00
Ejections	—	21·90	11·40
		24·95	

Fat	12·40
Normal fat	0·17
Difference	12·23
46 grammes of cocoa, dry matter 42 grs. ·32 contained, fat	22·27
Fat absorbed in twelve hours	10·04
Per hour	0·83

Assimilation or Combustion of the Food.—

	gr.
Removed or thrown out of the digestive apparatus	24·95
Intestinal matters and normal ejections.....	3·85
Substances found in the intestines and ejections	21·10
Dry cocoa ingested	42·32
Assimilated, or consumed in 12 hours	21·22
Per hour	1·77

0 gr. ·83 of butter of cocoa ought to contain about 0 gr. ·66 of carbon. 1 gramme of legumin, which makes up the quantity of alimentary matter, assimilated, or burnt in an hour, contains 0 gr. ·51. We have, then, for the carbon introduced every hour into the organism 1 gr. ·71. This number approaches that of 1 gr. ·25, which represents the carbon consumed by the respiration of the animal; but, nevertheless, there is a very sensible difference. As cocoa is very properly looked upon as, in a very high degree, proper for food, I made a fresh experiment to ascertain once more the amount of assimilation.

TENTH EXPERIMENT.

Another Duck crammed with Cocoa.—Between seven in the morning and one in the afternoon, a duck received 31 grs. ·7 of cocoa. After death we extracted from the crop 8 grammes of the seed; there remained, therefore, 23 grs. ·7, as the weight of the cocoa digested, or in the progress of digestion; we extracted—

	Wet. gr.	Dry. gr.
From the duodenum and gizzard.....	6·09	2·89
From the intestines	28·20	4·60
Ejections	—	9·90
		17·39
Intestinal substances and normal ejections		3·05
Substances found in the intestines and ejections		14·34
Dry cocoa ingested		21·80
Assimilated, or burnt in six hours ..		7·46
Per hour		1·24

This was still further distant from the desired number than the previous result. Nevertheless, these experiments show that the quantity of fat absorbed in a given time by the inner surface of the digestive organs is perceptibly the same, whatever may be the nature of an aliment superabundantly provided with fatty principles. Thus cocoa, which contains one-half of its weight of a butyraceous substance, pork fat, and butter mixed with rice, have furnished, every hour, about 8 decigrammes of fat. To this quantity the absorbent power of the organs of the animal on which we experimented appears to be confined. By this we see that we ought not to pass a certain limit in the proportion of the fatty substances introduced into a ration, if intended to produce a deposit of fat, because, beyond that limit the fat will pass away with the excrements—a perfect loss.

The absorption of a certain quantity of fatty substances during nutrition being a constant phenomenon, in order to ascertain whether there is a production of fat during the same process, it will be proper to make the experiments with substances entirely destitute of fat; for if, after the digestion of substances of this nature, the fat furnished by the chyme, or by the ejections, does not exceed that which we know exists under the same circumstances, when the animal receives no food, we shall possess, if not a proof, at least very strong reasons for admitting that there has been no development of fatty principles in the digestive apparatus. In fact, as I have already observed, it would be hardly natural to suppose that the fat produced had been completely absorbed. To be satisfied of the formation of fatty matter, it would be necessary that the fat extracted after feeding should exceed the normal fat.

As all kinds of food, after removing the fatty substances, are essentially composed of two orders of principles, nutritive nitrogenated substances, and those which contain no

nitrogen, I made my experiments, in succession, with starch, sugar and gum, and afterwards with albumen and casein.

ELEVENTH EXPERIMENT.

A Duck crammed with Starch.—At 7 o'clock in the morning we crammed a duck, which had fasted six-and-thirty hours, with fragments of starch. By midday we had injected 60 grammes, representing 51 grs.·78 of dry starch. The duck was killed at four o'clock in the afternoon; nothing was left in the crop. In the duodenum, a yellow, acid, pulpy, matter; gizzard empty; in the intestines an homogenous liquid, of a pale yellow colour, and acid, which became thicker in the large intestine; ejections yellow, extremely liquid, and acid; a very small quantity of substance belonging to the urine, a green matter, like that in the cœca, and a tolerably abundant mucus; we extracted—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum	0·80	0·20	0·006
,, the intestines	20·22	3·62	0·138
,, ejections ..	—	4·02	0·035
		7·84	
Fat			0·179
Normal fat			1·170
Difference			0·009

The fat found in the digestive organs, and in the excrements does not exceed the normal fat; at least the difference is of that order of variations which fatty matter presents when observed in the intestines and excrements of ducks after being deprived of food.

Assimilation or Combustion of the Food.—

	gr.
Extracted or thrown off from the digestive apparatus	7·84
Intestinal matters, and normal ejections	3·80
Matters found in the intestines and ejections	4·45
Dry starch ingested	51·78
Assimilated, or burnt in nine hours	47·33
Per hour	5·26

The 5 grs.·26 of starch conveyed into the organism contained 2 grs.·37 of carbon, a much greater quantity than was necessary (namely 1 gr.·25), to support respiration for an hour.

TWELFTH EXPERIMENT.

A Duck crammed with Sugar.—At six in the morning, we began to ingest pieces of very dry sugar; the experiment lasted nine hours. Half an hour after the first ingestion, the duck had a very copious and liquid evacuation. We gave it 60 grammes of sugar. The ejections contained sugar. We obtained—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the intestines and gizzard	11·50	2·80	0·110
Ejections	—	10·00	0·055
		12·80	
Fat			0·165
Normal fat			0·170
Difference			0·005

Assimilation or Combustion of the Food.—

	gr.
Extracted or thrown of from the digestive apparatus	12·80
Intestinal matters and normal ejections	3·89
Found	9·41
Dry sugar ingested	60·00
Assimilated, or burnt in nine hours	50·59
Per hour	5·62

5 grs.·62 of sugar contain about the same quantity of carbon as that found in 5 grs.·26 of starch, assimilated in the preceding experiment.

THIRTEENTH EXPERIMENT.

A Duck crammed with Gum Arabic.—Alimentary substances, not unfrequently, containing matters analogous to gum, I thought this substance would be absorbed as rapidly as sugar and starch had been; but experiment did not confirm my anticipations.

We ingested 50 grammes of gum arabic. The ejections, during nine hours, were mucilaginous, and slightly acid. When evaporated, they left a residue that possessed all the properties of gum; and weighed, when well dried, 46 grammes. Almost the whole of the gum, therefore, had escaped digestion. The dry matter, treated with water, left a residue, from which I extracted 0 gr. ·11 of uric acid; the same quantity of acid as that yielded by a duck kept fasting for nine hours.

These experiments, therefore, render it extremely probable, that sugar and starch do not occasion the production of fat during the time they remain in the digestive apparatus; and, in addition to this, they show that the same substances are absorbed with such great rapidity, that they convey into the organism more of the elements of combustion than are necessary for the purposes of respiration. I will examine, now, how nitrogenated alimentary principles comport themselves when they are placed under similar circumstances.

FOURTEENTH EXPERIMENT.

A Duck crammed with Albumen.—We gave a duck, which had received no nourishment for thirty-six hours, the white of an egg made solid by heat.

	grs.
At nine in the morning we ingested	60
At eleven	60
At two in the afternoon	50
At half-past four	50
At half-past seven	50
	270

The duck was killed at nine in the evening, and we extracted, from the crop 69grs.·35 white of an egg, there remained 200grs.·65 of the quantity submitted to digestion. After a lengthened desiccation, we found that the white of an egg contained 0·138 of dry matter; say, 27grs.·69 for 200grs.·65.

Two hours after the first ingestion, it had an abundant evacuation, charged with uric acid. The duck had not drank, and this is explained by the large quantity of water contained in the coagulated albumen.

In the duodenum and gizzard, the food was found in small pieces, enveloped in a glairy paste, of a yellow colour, and acid; the chyme, which occupied the small intestine, was tolerably fluid, homogenous, and of a deep green colour; the fluidity diminished as it approached the large intestine. Before it reached the point of junction of the cœca, the intestinal canal was greatly distended by a fetid gas, for the length of 5 centimetres. Beyond that, in the direction of the cloacum, was found a green substance, very thick, and of a disagreeable smell, it turned the red paper of turnsol, blue; we extracted—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum and gizzard	13·23	5·03	0·03
From the intestines	23·73	4·28	0·27
Ejections	—	7·40	0·07
		16·71	

Yellow fat of the consistence of butter	0·37
Normal fat	0·17
Difference	0·20

Thus we find an excess of 2 decigrammes, over the normal fat, and this excess must be a minimum quantity, because fat is constantly absorbed during the passage of the food along the intestinal canal. If this excess originated from the fatty substance that may be met with, in very small quantity, in the white of an egg, the latter must have contained 0gr.·006. But so large a quantity could not pass undetected, because in treating with ether as we did, 2 grammes of dried white of egg, reduced to an impalpable powder, we should have extracted 0gr.·012 of fatty matter, while in reality this substance did not weigh quite 1 milligramme.

Assimilation or Combustion of the Food.—

	gr.
Extracted, or thrown off from the digestive apparatus	16·71
Intestinal matters and normal ejections	3·73
Collected	12·93
Dry albumen ingested	27·69
Assimilated, or burnt, in 12 hours..	14·71
Per hour	1·23

1gr.·23 of albumen, fixed in the organism, in the course of an hour, contains at most 0gr.·67 of carbon, while the animal consumes 1gr.·25 albumen, therefore, with respect to the combustion of respiration it is an insufficient food.

The difficulty of ingesting coagulated white of egg, on account of its volume, induced me to repeat this experiment, employing white of egg previously deprived of a portion of its humidity by drying it.

FIFTEENTH EXPERIMENT.

Another Duck crammed with Albumen.—The white of egg, cut into small pieces, was placed in a stove; as the pieces diminished in volume they became transparent at the edges, the centres remaining opaque. We forced the duck to take 225 grammes of the white of egg, which, after being partially dried, weighed no more than 42grs.·50: but as this coagulated white contained only 0gr.·138 of dry substance, the 42grs.·50 really contained but 31grs.·05 of albumen, if entirely deprived of water.

We began to cram the bird at six in the morning and killed it at nine in the evening. We removed pieces from the crop, which, when dried, weighed, in powder, 5grs.·88, this reduced the dry albumen digested to 25grs.·17.

The substances contained in the intestines, and the ejections, offered the same characteristics as those already described in the last experiment, the only difference to be noticed is, that no gas had accumulated in the intestinal tube. We extracted—

	Wet.	Dry.	Fat.
	gr.	gr.	gr.
From the duodenum and gizzard ..... 4·50 / From the intestines .. 15·79		3·74	0·40
Ejections	—	6·40	0·13
		10·14	0·53

	gr.
Fat almost white, of the consistence of butter	0·53
Normal fat	0·17
Difference	0·36

Assimilation or Combustion of the Food.—

	gr.
Extracted or thrown off from the digestive apparatus	10·14
Intestinal substances, and normal ejections	4·07
Collected	6·17
Dry albumen ingested	25·17
Assimilated, or burnt, in 15 hours	19·00
Per hour	1·27

Here again the elements of the albumen introduced into the organism, which did not reappear in the excrements, did not contain sufficient carbon for the purpose of respiration.

(*To be continued.*)

NEW COMBINATIONS OF CYANIDE OF MERCURY.*

BY M. POGGIATE.

Cyanide of mercury, so singular on account of its reactions, like bichloride of mercury, possesses electro-negative properties, and readily combines with the bromides, chlorides, and iodides, and even with the oxysalts. Nevertheless, up to the present time, we are only acquainted with its combinations with the metallic bromides, and a small number of other salts. I therefore thought it would be interesting to study those it forms with the chlorides. I will consider, in another memoir, several compounds to which it gives rise, by uniting with the metallic iodides, and the oxisalts.

These double salts have been usually prepared by adding cyanide of mercury to a solution of a metallic chloride, saturated, while cold, by filtering the liquid, and evaporating it at a low heat. Sometimes it has been found necessary to evaporate the liquid in a vacuum, to obtain regular crystals.

The analyses of the greater number of these compounds offer no difficulty. The proportion of cyanide was determined by treating a diluted solution of the double salts with hydrosulphuric acid gas, and by heating it gently. The liquid was also rendered acid by means of hydrochloric acid. To obtain a pure black precipitate we pass through it for a long time, a stream of hydrosulphuric gas. The combinations of cyanide and sulphuret of mercury which are formed, in the first instance, are completely transformed into sulphuret of mercury, by an excess of hydrosulphuric acid gas. The quantity of cyanide of mercury is deduced from the weight of the sulphuret obtained.

The solution, separated by filtration from the sulphuret of mercury, contained the metallic chloride, the proportion of which was ascertained by evaporating the liquid with the usual precautions.

We determined the hydratation of these double salts, sometimes by heating them gently in a sand-bath, at others by drying them by means of concentrated sulphuric acid, either in a vacuum or simply in a closed apparatus. The crystals were previously deprived of the intervening water, by pulverising them and pressing them between leaves of filtering paper, taking the precaution of renewing the paper before it becomes too wet. The dishydratation is to be effected immediately afterwards.

CYANIDE OF MERCURY AND HYDROCHLORATE OF AMMONIA.

This is obtained by dissolving the cyanide of mercury and hydrochlorate of ammonia in water, and evaporating the liquid by means of a gentle heat. It crystallises in long prismatic needles. The salt is more soluble in hot than in cold water. It has a mercurial taste, and when exposed to the air, it becomes opaque. Like the cyanide of mercury it is decomposed by the action of heat, and disengages carbonic acid, cyanogen, vapours of mercury, and hydrochlorate of ammonia. Hydrochloric and hydrosulphuric acids displace the hydrocyanic acid. Submitted to the action of sulphuric acid, it forms, at a high temperature, cyanogen, sulphurous, carbonic, and hydrochloric acids.

The composition of this salt is represented by—

$$2Hg\,Cy,\ N\,H^3,\ H\,Cl.$$

In my calculations I have adopted the number 175·08 as the equivalent of nitrogen, as determined by M. Pelouze; and, for chlorine, the number 450, admitted by M. Gerhardt. I have also adopted, for mercury, the number 1250·90, according to Messrs. Erdmann and Marchand.

If we submit the mother-liquor in which the preceding salt is formed to a slow evaporation, we obtain brilliant, long, triangular crystals. This new combination has not the same composition as the salt I have just noticed, as the experiments indicated in my memoir show. The following is the formula:—

$$Hg\,Cy,\ 2N\,H^3,\ H\,Cl.$$

* *Comptes Rendus.*

CYANOCHLORIDE OF MERCURY AND SODIUM.

It crystallises in beautiful transparent needles containing no water of crystallisation. If the crystals are rapidly deposited we obtain numerous interlaced needles, but if we place the solution in a deep vessel, covered with paper pierced with holes, the crystallisation is perfectly regular. This salt readily dissolves in water, especially when at a boiling heat. It is, on the contrary, scarcely soluble in alcohol. The double salt is composed of—

Hg Cy, Na Cl.

CYANOCHLORIDE OF MERCURY AND BARIUM.

It crystallises in beautiful quadrangular prisms, which are transparent, and cut off obliquely at the summits; it is efflorescent in air, without losing its crystalline form; submitted to the action of heat, it easily gives up its water of crystallisation, and by raising the temperature it is decomposed, and gives out cyanogen, mercury, and chloride of barium. It is precipitated by the sulphates, soluble carbonates, and hydrosulphuric acid. Its formula is—

Hy Cg, Ba Cl + 4HO.*

CYANOCHLORIDE OF MERCURY AND STRONTIUM.

I obtained this combination by adding 2 equivalents of cyanide of mercury to 1 equivalent of chloride of strontium. By spontaneous evaporation it deposited crystals united in groups; each group being composed of silky and brilliant prisms. This salt is extremely soluble in water; exposed for several hours to a dry air it loses its brilliancy. Like the last salt, it is decomposed by heat, soluble sulphates, alkaline carbonates, hydrosulphate of ammonia, and hydrosulphuric acid. Analysis shows its formation to be—

2Hg Cy, Sr Cl + 6HO.†

CYANOCHLORIDE OF MERCURY AND CALCIUM.

When we add 1 equivalent of chloside of calcium to 2 equivalents of cyanide of mercury by the assistance of a gentle and uniform heat, a new salt is produced, which crystallises in beautiful prismatic needles; extremely soluble in water and efflorescent in the air. Its formula is—

2 Hg Cy, Ca Cl + 6 HO.

* The equivalent of barium, according to M. Pelouze, is 858·03.

† According to M. Pelouze, the equivalent of strontium is 518·03.

CYANOCHLORIDE OF MERCURY AND MAGNESIUM.

This salt crystallises in tufts composed of prismatic needles; it remains unchanged in dry air, but deliquesces if the air is rather moist. I obtained it perfectly crystallised by placing under the evaporating bell a solution containing 2 equivalents of cyanide of mercury and 1 equivalent of chloride of magnesium. It may be also obtained by spontaneous evaporation. It contains—

2 Hg Cy, Mg Cl + 2HO.

CYANOCHLORIDE OF MERCURY AND MANGANESE.

A solution containing 1 equivalent of chloride of manganese and 1 equivalent of cyanide of mercury, when placed in the air, yields in the same manner as protochloride of manganese, transparent, colourless crystals in the form of quadrilateral tables. The cyanochloride of mercury and manganese is extremely soluble in water and efflorescent in contact with air; it becomes of a rose colour at the ordinary, and is decomposed at an elevated, temperature. Its formula is—

Hg Cy, Mn Cl + 3 HO.

THE CYANOCHLORIDE OF MERCURY AND ZINC

forms right angled quadrangular prisms, soluble in water and efflorescent in the air. Their formula is—

2 Hg Cy, Zn Cl + 6 HO.

CYANOCHLORIDE OF MERCURY AND NICKEL

crystallises with difficulty; it is greenish-blue, deliquesent, and extremely soluble in water. It should be composed, according to three experiments, which still leave something, however, to desire, of—

Hg Cy, Ni Cy + 6 HO.

CYANOCHLORIDE OF MERCURY AND COBALT.

This salt, which is obtained like the preceding, crystallises in groups of papillæ, of a reddish-yellow colour, which become of a rose colour in the air, and rapidly dry. Exposed to an elevated temperature, they are decomposed, and give out mercury, water, cyanogen, &c.

The solution of this salt, like that of cobalt, is sometimes blue, at others rose-coloured; it is blue when much concentrated, and rose-coloured when diluted. It is composed of—

Hg Cy, 2 Co Cl + 4 HO.

CYANIDE AND BICHLORIDE OF MERCURY.

The cyanide combines with the bichloride of mercury in the same manner as with the electro-positive chlorides. To obtain this

combination, we dissolve in water 1 equivalent of bichloride, and evaporate the filtered liquor by means of a gentle heat By cooling it, quadrangular pyramidical crystals are formed, semi-transparent, unchangeable in the air, and soluble in water.

The solution of this double salt is precipitated by nitrate of silver, and the precipitate is entirely composed of chloride of silver. When we add to it hydrochloric acid and iron, it abandons the mercury, and, if we afterwards add potash, it forms Prussian blue.

I have described in my memoir the process I adopted to determine the composition of this combination. It contains—

Hg Cy, Hg Cl.

The bichloride of tin appears to combine with the cyanide of mercury; but the double salt crystallises in so confused a manner that I have not thought fit to analyse it.

The protochloride of tin, on the contrary, instantly decomposes cyanide of mercury, and produces a gray precipitate, composed of mercury, oxide of tin, and of hydrocyanic acid, which is disengaged from the liquid with a true effervesence.

I shall confine myself to mentioning, in conclusion, two new combinations of cyanide of mercury, with iodide of calcium, and the formiate of ammonia, and I intend to return to the subject.

CYANIODIDE OF MERCURY AND CALCIUM

crystallises in beautiful silky tufts; it is extremely soluble in water, and slightly efflorescent. Its composition is expressed by the following formula:—

2 Hg Cy, Ca I + 6 HO.

CYANIDE OF MERCURY AND FORMIATE OF AMMONIA.

It crystallises in triangular prisms; a temperature of 392° F. decomposes it into water, hydrocyanic acid, and cyanide of mercury; under the influence of hot sulphuric acid, this salt gives out a gaseous oxide of carbon, by the decomposition of formiate of ammonia. It is composed of—

Hg Cy, C^4 H^2 O^3 N H^3.

CYANIDE OF MERCURY AND CHROMATE OF POTASH.

This curious compound, discovered by Messrs. Caillot and Poitevin, not having been analysed, I took the opportunity of determining its composition.

This salt, prepared according to the directions of chemists, crystallises in blade-shaped needles; it is soluble in water, unchanged in the air, and takes fire at a high temperature. The composition of the salt is represented by— 2 Hg, K O Cr O^3.

AN INQUIRY INTO SEVERAL NEW SULPHURETTED COMBINATIONS OF METHYL.*

BY M. AUG. CAHOURS.

In following out my experiments on the sulphuretted combinations of methyl, I obtained two new products, true compound ethers, corresponding with the carbonate of oxide of methyl, in which the whole or part of the oxygen was replaced by sulphur.

When we cause iodine, in fine powder, to act on sulphocarbomethylate of potash dissolved in wood spirit, sulphur and iodide of potassium are separated, at the same time a gas is disengaged, formed chiefly, of oxide of carbon. By pouring water on to the mixture, a heavy brown oil was separated, holding sulphur in solution, which it soon abandons, under the form of well-defined crystals; this oil, when purified by washing it in distilled water, and by one or two rectifications, possesses a composition that may be represented by—

C^6 H^6 S^2 O = C^2 S^2, C^4 H^6 O.

It is, therefore, a sulphocarbonate of oxide of methyl, a substance perfectly analogous to the sulphocarbonate of oxide of ethyl recently obtained by M. Zeise, by the reciprocal action of iodine and xanthate of potash. We have just seen that I obtained the new compound in question by the method pointed out by that philosopher.

The density of the vapour of this product, determined by experiment, has led me to the number 4,266. Calculation gave 4,234, by supposing that its molecule represented two volumes of vapour; it exhibits, therefore, a molecular grouping, exactly resembling carbonic ether.

The reaction by which this compound was produced, may be represented by the following formula:—

2 C^2 S^2, C^4 H^6 O K O + I^2 = I^2 K + 2 S + C^2O + C^2 S^2, C^4 H^6 O.

When purified, the sulphocarbonate of oxide of methyl is liquid, easily decomposed, and slightly yellow. Its odour, extremely strong and enduring, is somewhat aromatic. Its density is 1,123, at 122° F.; it boils at about 340°; and is distilled without change. Its vapours takes fire at the approach of an ignited body, and it burns with a clear and luminous flame, giving out a strong smell of sulphurous acid. In the presence of an alcoholic solution of potash, it is decomposed, giving rise to a methylic mercaptan, which remains in solution, and carbonate of potash which is precipitated.

Chlorine attacks its energetically; it even

* *Comptes Rendus.*

gives out light, producing a crystallised product, which disappears in an excess of chlorine, and is transformed into a liquid substance.

The existence of a combination of oxide of methyl and sulphuret of carbon being once well established, I attempted to combine sulphuret of methyl with the same body. I succeeded without difficulty, by heating, in a distillatory apparatus, a mixture of concentrated solutions of sulphomethylate of lime and sulphocarbonate of sulphuret of potassium; it was then condensed in the receiver in the form of a watery liquid, at the bottom of which a very heavy yellow oil was deposited. This last, being washed in water, and afterwards dried over chloride of calcium, exhibited no constant boiling point. If we select a portion, distilled at about 392° F., at which temperature it is most abundant, and then purify it by several distillations, we finally obtain a product giving, by analysis, numbers leading to the formula—

$$C^6\ H^6\ S^3 = C^2\ S^2,\ C^4\ H^6\ S.$$

The density of its vapour, ascertained by experiment pointed out, the number 4,652. Calculation gave 4,785, on the supposition that its molecule furnished 2 volumes of vapour as in the preceding combination.

The sulphocarbonate of sulphuret of methyl is a yellow liquid, with a strong and penetrating odour. It is scarcely soluble in water, but alcohol and ether dissolve it in all proportions. Its density is 1,159, at 64·4° F., and it boils at from 392° to 401° F.

Chlorine and bromine attack it with energy, the latter produces a crystallised substance, having the appearance of bichromate of potash. Its composition is expressed by the formula—

$$C^2\ S^2\ C^4 \left\{ \begin{matrix} H^4 \\ Br^3 \end{matrix} \right\} S,$$

which only differs from sulphocarbonate of sulphuret of methyl by the circumstance of 1 equivalent of bromine having taken the place of 1 equivalent of hydrogen.

Nitric acid energetically attacks it, giving off golden-coloured vapours.

The oxide of methyl can, therefore, unite in two proportions with sulphuret of carbon to form the compounds $C^2\ S^2$, $C^4\ H^6\ O$, corresponding with carbonic ether, $C^2\ O^2$, $C^8\ H^{10}\ O$, and 2 $C^2\ S^2$, $C^4\ H^6\ O$, M O, and to the carbonates 2 $C^2\ O^2$, $C^8\ H^{10}\ O$, M O.

The monosulphuret of methyl, which corresponds with the oxide, can, in its turn, unite itself with sulphuret of carbon, as we have just seen, to form the compound—

$$C^2\ S^2,\ C^4\ H^6\ S.$$

We have now to endeavour to discover the combination 2 $C^2\ S^2$, $C^4\ H^6\ S$.

Up to the present time, I have attempted, in vain, to produce any of the salts formed by this acid, whose existence is, nevertheless, extremely probable.

The two combinations, whose existence I have just noticed, are, therefore, two genuine compound sulphuretted ethers, which comport themselves like the ordinary oxigenated compound ethers, as we may convince ourselves by comparing the following equations—

Carbonic ether.

$$C^2\ O^2,\ C^8\ H^{12}\ O + K\ O,\ H^2\ O =$$

Alcohol.

$$C^2\ O^2\ KO + C^8\ H^{12}\ O^2.$$

Sulphocarbomethylic ether.

$$C^2\ S^2,\ C^4\ H^6\ O + KO,\ H^2\ O =$$

Methylic mercaptan.

$$C^2\ O^2\ KO + C^4\ H^8\ S^2.$$

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

IMPROVEMENTS IN ELECTRIC TELEGRAPHS.*

BY HENRY HIGHTON.

THIS invention consists in communicating signals by the motions produced in strips of metallic leaf by passing electric currents through them.

A signal apparatus, constructed on this principle, consists of a glass tube, furnished with brass caps at top and bottom, which are connected with wires, employed for conveying the currents of electricity, a strip of metallic leaf (gold leaf is the kind of metallic leaf generally used by the patentee), suspended loosely between the two brass caps, and in metallic contact therewith; the upper end of the metallic leaf is fixed at right angles to its lower end, so that the leaf, from whatever direction it is seen, will present

* *Newton's London Journal.*

some part of its flat surface to the eye. Near to the metallic leaf (as on the outside of the glass) is placed either of the poles of a magnet. The effect of this arrangement is, that when a current of electricity is caused to pass through the circuit, and, therefore, through the metallic leaf included in it, the leaf is deflected to one side or the other, according to the direction of the current; and the motions thus produced may be repeated and combined, and used for the purpose of indicating letters, figures, or other conventional signals.

One signal apparatus, of the above construction, is placed at each terminus of telegraphic communication, and others may be placed at intermediate points. Each terminus and each intermediate station is provided with a voltaic battery, and with one of the key-boards used with "single magnetic-needle electric telegraphs." The attendant at either terminus, or at any intermediate station, makes the requisite connections for causing an electric current to pass in either direction through the circuit, and, therefore, through the metallic leaf of the signal apparatus at each station, thus causing the metallic leaf of every apparatus to move simultaneouly to either side, so as to give the desired signal. The key-board of each station has a handle, by moving which an electric current is caused to pass through a circuit in connection with a system of alarums at the terminal and intermediate stations, similar to those in use with magnetic-needle electric telegraphs.

The patentee claims, firstly, the application of metallic leaf for giving signals in electric telegraphs. Secondly, the combining into one system of electric telegraphs, so as to act together, two or more apparatus adapted for giving signals at different places by means of metallic leaf. Thirdly, the combining of alarum apparatus in electric telegraphs with apparatus for giving signals by means of metallic leaf.

POTATO DISEASE CAUSED BY ATMOSPHERIC INFLUENCE.*

The following facts may throw some light on this mysterious subject, and may induce somebody to investigate the elements of the atmosphere; for, although it is out of the power of man to alter natural laws, yet science may unfold some method of counteraction whereby the disease may be averted or mitigated to such an extent that the potato crop may again be cultivated as a profitable article of food. The following experiments were commenced on the 3rd of September, and examined on the 13th Oct. The potatoes were all carefully selected, put into garden-pots, with their several mixtures, covered over with moss, and then buried about one foot six inches deep in the ground, except the Nos. 10 and 11, which were laid on the ground:—

No.	September 3.	Mixture.	October 13.
1	5 sound potatoes	Lime	All sound.
2	5 do., 1 diseased		5 do., 1 diseased.
3	5 sound do....	Charcoal ..	All sound.
4	5 do., 1 diseased		5 do., 1 diseased.
5	5 sound do....	Soil	All sound.
6	5 do., 1 diseased		4 do., 2 diseased.
7	5 sound do.....	Nothing	All sound.
8	5 do., 1 diseased	mixed ..	5 do., 1 diseased.
9	,, 5 do.....		All got worse.
10	5 sound do.....	Open air ..	5 sound.
11	5 do., 1 diseased		5 do., 1 diseased.
12	5 do.....	Carbonate of ammonia.	All very badly diseased.

The diseased potatoes were all much worse.

In experiments Nos. 2, 4, 6, and 8, where a diseased potato was placed in the midst of sound ones, there was not the slightest indication of the disease being propagated by contact, except in No. 6, one potato appeared a little diseased, but not at the point of contact with the diseased potato; so that I imagine the disease had probably commenced before I selected them, but had escaped my notice; for I have had several instances, quite as decisive as those now recorded, that contact with diseased potatoes does not produce disease in sound healthy tubers. Those in No. 12, which were mixed with a small quantity of carbonate of ammonia, were all much diseased, which led me to suspect that the disease is caused by a superabundance of ammonia (in some state) in the atmosphere; and, to test the correctness of my supposition, I had recourse to the following experiments:—On the 13th Oct. I put five sound potatoes in a jar which had had carbonate of ammonia in it, and smelt very strongly of that substance, and also five sound potatoes in a jar of the same size. I covered them both closely up, and placed them in a pine stove. They were examined on the 17th Oct.; and those in the jar with

*. *Gardeners' Chronicle.*

the carbonate of ammonia were all showing symptoms of disease, while those in the other jar were quite sound. At the same time I put green tops of potatoes, quite healthy, into both of the jars, and examined them on the 19th, when those in the jar with carbonate of ammonia showed appearance of disease, while those in the other jar discovered no observable difference. On the 22nd Oct. those in the carbonate were all quite black, presenting just the same appearance as the potato fields did in August and September, whilst the leaves of those in the sound jar only became of a yellowish hue, as might be expected from natural decay.

CAUSE OF POTATO ROT.

A CORRESPONDENT of the *Whitehaven Herald* observes:—"It appears that the mischief rests between the air and the leaves. When first attacked they have the appearance of being seared, as if the air was too corrosive for them; and the consequence is they cannot perform their function properly; the juices are therefore not matured, but deposited in the tuber in an impure state—the same state, or nearly so, as when taken from the earth. It is as if the blood of a man was conveyed to the various organs of his body without passing through the lungs, for the leaves are to a plant what the lungs are to a man; imperfect nutrition would follow, and the man die and putrify very soon. Does any correspondent know of potato crops grown with guano affected as much as those grown with farmyard manure? A gentleman last year had a crop of potatoes grown with guano, and, with the exception of a few stitches, all were sound. To a solution of a diseased potato, which had a very offensive odour, a small quantity of carbonate of ammonia was added. The odour disappeared, and the ordinary smell of the potato was substituted. Is it that, on account of the seared state of the leaf, sufficient nitrogen is not absorbed? And is it that the nauseous potato liquor, to which the ammonia was added, received nitrogen from the ammonia, and so, having received the required element, was restored to its proper condition and odour? And is it that the potato crop grown with guano received the sufficient amount of nitrogen by the root, and so compensated for not receiving it through its ordinary channel—the leaves. These cases bear upon the same point, and, though they should not afford a solution of the matter, nevertheless, may afford points to start from."

POTATO DISEASE IN DENMARK.*

LITERAL translation of a report by Professor Liebmann, made officially to the Polytechnic Institution of Copenhagen.—"Although the potato complaint has already in the course of several years been known in various places in Europe, it did not become the subject of general attention before last year, when almost all over Europe it caused great devastation. This year, also, the sickness has broken out suddenly, and with great violence at the same time, all over the country, and has in a short time destroyed the greatest part of the parts of the potato plant vegetating above ground; but it is not yet decided whether the complaint will have as great influence on the tubers as was the case last year. According to all accounts we have been able to collect, as well as from our own observations, the complaint this year has chiefly attacked the early ripe potatoes; but those later ripe have been much more free. Although, where the potato complaint last year made its devastations, it has become a subject of investigation carefully conducted by individuals as well as by committees appointed to this effect, employing large sums of public money for the promotion of these inquisitions; still, notwithstanding all that is done in this direction, and that our literature has been increased to an enormous extent, the result of all these endeavours is comparatively nothing. None of the remedies so variously proposed have been effective. Last year attention was only drawn to the illness when far advanced; its first beginning as well as its cause came not at all under experienced and scientific men's observation. This year, when attention has been early directed to the vegetative process of the potatoes, it has been possible to observe all the phenomena of the illness from its beginning, and there can no longer be a doubt of the cause of the disease. It is a parasitical fungus belonging to the mildew or thread fungi which attacks the parts of the potato above ground, and which shortly, in the way peculiar to fungi, destroys the cellular texture of leaves, flower, and stem; this fungus presents a fine cobweb texture of uncoloured branched fibres, and increases with great speed by elastic germinating grains, which only appear by a considerable magnifying power. These germinating grains are so small and so light that they are floating about in the air, and descending with the dew-drops on the sound plants, develop themselves in a few hours to threads, and destroy the leaves. It is certain that the illness i produced by this parasitical fungus. The

* *Athenæum.*

sickness in the tubers appears only some time after the part of the plant above ground is destroyed, and shows itself by destroying the cellular texture which, by the destruction of the leaves, is deprived of the regular nourishment which is derived from these parts. The existence of the potato thread fungus is like all fungi generally, only brief, and it is only plainly discernible on leaves not yet blackened or faded. We feel bold to assert that the period of vegetation of this parasitical fungus this year has been confined to the first fourteen days of August, and that it will only be the consequences of the ravages of the fungus during these fourteen days that will be felt this autumn."

ON AN IMPROVEMENT IN THE DAGUERREOTYPE PROCESS BY THE APPLICATION OF SOME NEW COMPOUNDS OF BROMINE, CHLORINE, AND IODINE, WITH LIME.*

BY R. J. BINGHAM.

ALL persons who have practised the Daguerreotype must have remarked, that in warm weather a considerable deposition of moisture takes place upon the glass or slate cover used to confine the vapour in the bromine or accelerating pan. This moisture must also necessarily condense upon the cold metallic surface of the plate during the time it is exposed to the bromine vapour. In fact, I have been informed by a number of professional Daguerreotypists (and I have experienced the difficulty myself), that they were unable to obtain perfect pictures during the excessive heat of the late season; and a very clever and enterprising operator, who last year made a tour on the continent, and brought home some of the finest proofs I have ever seen, entirely failed this season in obtaining clear and perfect pictures, from the constant appearance of a mist or cloud over the prepared surface. This appears to be caused by the deposition of moisture upon the plate, arising from the water in which the bromine is dissolved. To obviate this, some have recommended the pan to be kept at a low temperature in a freezing mixture; and M. Daguerre, in a communication to the French Academy of Sciences, recommends the plate to be heated; but in practice both these plans are found to be unsuccessful. (See Lerebour's *Traité de Photographie.*)

It appeared to me, that if we could avoid the use of water altogether in the accelerating mixture, not only would the difficulty I have mentioned be avoided, but a much more sensitive surface would be obtained on the plate. With this view, I endeavoured to combine bromine with lime, so as to form a compound analogous to bleaching powder. In this I was successful, and find that bromine, chloride of iodine, and iodine, may be united with lime, forming compounds having properties similar to the *so-called* chloride of lime.

The bromide of lime* may be produced by allowing bromine vapour to act upon hydrate of lime for some hours: the most convenient method of doing this is to place some of the hydrate at the bottom of a flask, and then put some bromine into a glass capsule, supported a little above the lime. As heat is developed during the combination, it is better to place the lower part of the flask in water at the temperature of about 50° F.; the lime gradually assumes a beautiful scarlet colour, and acquires an appearance very similar to that of the red iodide of mercury. The chloroiodide of lime may be formed in the same manner: it has a deep brown colour. Both these compounds, when the vapour arising from them is not too intense, have an odour analogous to that of bleaching powder, and quite distinguishable from chlorine, bromine, or iodine, alone.

Those Daguerreotypists who use chlorine in combination with bromine, as in Wolcott's American mixture, or M. Guérin's Hungarian solution, which is a compound of bromine, chlorine, and iodine, may obtain similar substances in the solid state, which may be used with great advantage. By passing chlorine over bromine, and condensing the vapours into a liquid, and then allowing the vapour of this to act upon lime, a solid may be obtained having all the properties of the American accelerator; or by combining the chloroiodide of lime with a little of the bromide, a mixture similar to that of M. Guérin's may be produced; but I really prefer, and would recommend the pure bromide of lime, it being, as I believe, the quickest accelerating substance at pre-

* *Philosophical Journal.*

* I call this substance bromide of lime, although there is a difficulty as to the composition of bleaching powder, and which would also apply to the compounds I describe. Some chemists regard the *chloride of lime* to be a compound of lime, water, and chlorine. Balard thinks it is a mixture of hypochlorite of lime and chloride of calcium; and the view of Millon and Professor Graham is, that it is a peroxide of lime, in which 1 equivalent of oxygen is replaced by 1 of chlorine.

sent known. By slightly colouring the plate with the chloroiodide, and then exposing it for a proper time over the bromide, proofs may be obtained in a fraction of a second, even late in the afternoon. A yellow colour should be given by the use of the first substance; and the proper time over the bromide is readily obtained by one or two trials. With about a drachm of the substance in a shallow pan, I give the plate ten seconds the whole of the first day of using the preparation, and add about three seconds for every succeeding one. The compound should be evenly strewed over the bottom of the pan, and will last with care for about a fortnight.

The great advantage of this compound is, that it may be used continuously for a fortnight without renewal; and, unlike bromine water, its action is unaffected by the ordinary changes of temperature.

LIME AS A MANURE.

A CORRESPONDENT of the *Farmers' Magazine* thus sums up the qualities of quicklime:—

1. If applied to green vegetables, quite hot from the kiln, it will destroy the tissue and carbonise the substance, itself being brought into the state of mild lime or chalk.

2. As powdered or air-slaked lime it will directly kill slugs and moluscous vermin, acting by its peculiar attraction for water.

3. As an alkali it will neutralise acids of every description, and hence is peculiarly useful if dusted over trees infested with lichens.

4. Its affinity for humic acid is predominant, as we have seen; and, therefore, it becomes a specific remedy wherever there is a redundance of inert decayed vegetable remains.

5. According to high chemical authority, it is capable of liberating potassa from clay and granite rocks, and of setting it at liberty from its combination with flint as an insoluble silicate of potassa.

6. It is a mistake to suppose that quicklime renders vegetable and animal remains soluble. These substances are partially soluble, as we have seen in the three alkalis; but the precipitate formed by the addition of lime is not soluble, or, at any rate, it is so far fixed that it will remain long quiescent in the ground, from which it can only be taken up in very small quantities, and by slow degrees, according to the capacity of the vegetable for such food. Lime, then, acts as an antidote of redundant humous matter, attracting and fixing its acid as an innocuous humate.

IMPROVEMENTS IN THE MEANS OF OBTAINING AND PREPARING EXTRACTS FROM VEGETABLE MATTERS, AND IN THE APPARATUS CONNECTED THEREWITH.*

BY HENRY DIRCKS.

THIS invention relates, first, to manufacturing a concentrated extract of malt, combined with an extract of unmalted grain or farinaceous matters—hops, or other vegetable matters may be added; secondly, to the apparatus to be used for evaporating extracts of such vegetable matters; thirdly, to applying the said apparatus to other similar purposes. After obtaining an infusion of malt, with or without unmalted grain, in the usual manner of mashing, it is then boiled with or without farina, hops, or other vegetable matters. This process is continued with great care at a temperature varying from 160° to 190° F., to avoid extracting the colour. Worts, prepared from the finest pale malt, with the best hops, are the extracts preferred for brewing from; the finest pale malt only is used when intended for home-made wines and beer. The extracts intended for colouring matter, and which have to be evaporated at a temperature of 200° and upwards, until sufficiently carbonised, are prepared by adding a portion of unmalted grain or farinaceous matter, generally in the proportion of one-third of the former to two-thirds of the latter, or thereabouts; the infusion being kept heated at a temperature varying up to about 167° F., until saccharised; after which, evaporation may be conducted from 212° to 300°, or any desired temperature. When the extracts are prepared to have medicinal properties they may be concentrated infusions of one quarter of malt, with 10 lbs. or 12 lbs. of ginger; or one quarter of malt, with about 4 lbs. of spruce and 4 lbs. of hops; or one quarter of malt, with one bushel of scurvy-grass, and 6 lbs. of hops; or about these proportions for each. Good beer may be brewed from the above proportions. The patentee claims—First, the preparation of a concentrated saccharine extract from the peculiar combination of malt and unmalted grain, or other farinaceous matters, with or without hops. Secondly, combining the foregoing extracts, and also those of malt, or malt and hops, with spruce, scurvy-grass, ginger, horseradish, liquorice or honey. Thirdly, the apparatus for collecting the body of steam. Fourthly, the application of the steam apparatus for preventing boiling over during violent ebullition in evaporating water, brine, or any other liquids.

* *Pharmaceutical Times.*

NEW MODE OF PRESERVING ANIMAL MATTERS.

BY E. COTTEREAU, JUN.

When an aqueous solution of sugar is allowed to act on the oxides, it is well known that certain definite combinations are formed, to which, in France, the name has been given of "saccharates." These salts have very strong antiseptic qualities; a fact the less doubtful from our previous knowledge of the antiseptic qualities of sugar. Acting on this principle, I have undertaken a series of experiments, not yet concluded, of which I purpose to give the results. The "saccharate" which I have used is that of chalk; and the muscular bodies, reptiles, for example, that I have kept in a solution of this salt for several months remain in a perfect state of preservation. A few of these specimens which I exposed to the air in open vessels have become dry by the evaporation of the fluid, but present no traces of putrefaction. I shall publish my experiments when concluded.

AN IMPROVED PREPARATION OF CHARCOAL.

BY R. L. JONES.

The first part of this invention consists in using currents of air to separate the fine from the coarse particles of charcoal or charred peat, when grinding the same; which fine particles may be employed instead of vegetable black, drop black, and lamp black, and also as a substitute for, or combined with, black lead, in the preparation of mixtures for lubricating axle-trees and machinery; the coarser particles may be used by iron-founders and others. This invention consists, secondly, in separating the fine from the coarse particles of ground charcoal or charred peat by currents of air, after the same has been ground in the usual manner. The charcoal or charred peat may be ground in any convenient close mill, but the patentee prefers one of the kind employed in grinding charcoal for the use of iron-founders; and he applies a cover thereto, containing holes for the entrance of the air, and furnished with valves to regulate the supply. From the top of a mill a pipe extends to a rotary fan or other exhausting apparatus, which is connected by another pipe with a long chamber, so constructed that the finer particles may be deposited therein and the air pass away. The chamber is thirty feet long, ten feet high, and ten feet wide; the the top, one end, and one side are composed of calico, stretched on light wooden framing, and the other side and end are formed by a wall. The action of grinding will cause the finer particles to rise in the mill, and they will be carried off by the currents of air into the long chamber, where they will be deposited on the floor, or in pockets descending from the floor or other part; and the powder will be of different degrees of fineness, according to the distance from the entrance of the chamber to the place where it is deposited. Although the patentee prefers the apparatus and means above described, for grinding and producing currents of air, he does not confine himself thereto. When the charcoal or charred peat has been ground in the ordinary manner, without the employment of currents of air to separate the fine from the coarse portions, the powder is introduced into a covered cylinder, or other convenient vessel; provided with a stirrer, and connected with an exhausting apparatus (similar to the mill above described); by which the fine particles are caused to proceed to the long chamber wherein they are to be deposited, the coarse particles remaining in the cylinder.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

BLOOD AS AN ANTIDOTE IN CASES OF POISONING BY ARSENIC.

BY M. F. APOIGER.

According to experiments made by M. Apoiger, arsenic has a great affinity for blood, and this affinity is of such a nature, that chemical combination takes place even in the stomach.

The following is M. Apoiger's account:—At mid-day, we gave a well-fed dog, suffering in the right eye from *pterygium*, and who had fasted for eighteen hours, 15 centigrammes of arsenous acid; and a quarter of an hour afterwards, 560 grammes (18 ounces) of fresh calf's blood; the dog was attacked with perspiration, trembling, thirst, nausea, and extreme weakness. In the evening, the

dog no longer felt these symptoms, and he neither vomited, had stools, nor passed his urine.

Three days afterwards, 20 centigrammes of arsenious acid were given to the same dog, and ten or twelve minutes afterwards, 375 gr. of blood. The result was the same; and in the evening the dog was in his normal state.

On the fifth day, we gave the animal 45 centigrammes of arsenious acid, and immediately afterwards, 280 grammes of blood. The pterygium disappeared completely four-and-twenty hours afterwards.

On the seventh day, we gave the dog 60 centigrammes of arsenious acid and 250 grammes of blood; and he had such profuse perspiration, that he resembled an animal just come out of the water. He passed stools and urine, and had a husky bark.

On the ninth day, we again gave the animal 1 gr. of arsenious acid, and 187 grammes of blood. This time, in addition to the usual symptoms, we observed convulsive movements, great agitation, and a difficulty of supporting itself. At night, all these symptoms disappeared.

The experiments were then discontinued, and the dog's health was completely re-established.

The author notices one remarkable circumstance in the absence of vomiting.

The dog having been destroyed, the blood was found to be gelatinous; the stomach and intestines were inflamed.

The blood extracted from the animal and analysed, was found to contain arsenic; it was also met with in the brain, but in smaller quantity.

"These experiments," observes the editor of the *Journal de Pharmacie*, "are curious; but we, nevertheless, think, that before they can be relied on, they ought to be repeated."

HISTORY OF THE INTRODUCTION OF THE GUTTA PERCHA INTO ENGLAND.*

BY DR. MONTGOMERIE.

I MAY not arrogate to myself the actual discovery of gutta percha; for although, previous to my introduction of it, it was quite unknown to Europeans, still it was known to a few of the inhabitants of certain localities of the Malayan forests; but even most of the native inhabitants of the towns and villages near those localities, to whom I showed it, did not know what it was, and it was likely to have remained unknown from the very trifling uses to which it was applied, being as far as I could ascertain only occasionally used to make handles for *parangs* (wood-choppers), instead of wood or buffalo horn.

As far back as 1822, when I was on duty at Singapore as assistant-surgeon to the residency, I had obtained the name of it, while making inquiries relative to caoutchouc, of which there are several varieties; and some very fine specimens were brought me, particularly one called "gutta girek" (the *i* sounded as in Italian, and the *k* almost mute); and I was told that there was another variety called "gutta percha," and sometimes "gutta tuban," which they said was harder than the "gutta girek;" but none of it was brought to me at that time, and I lost sight of it, having returned to the Bengal presidency. But being again sent on duty to the Straits' settlements, and while at Singapore, in 1842, I on one occasion observed in the hands of a Malayan woodsman the handle of a *parang*, made of a substance which appeared quite new to me. My curiosity was excited, and on inquiry I found it was made of the gutta percha, and that it could be moulded into any form by simply dipping it in boiling water until it became heated throughout, when it became plastic as clay, and when cold regained unchanged its original hardness and rigidity.

I immediately possessed myself of the article, and desired the man to fetch me as much more of it as he could get.

On making some experiments with it, I at once discovered that, if procurable in large quantities, it would become extensively useful; and, even if only in small quantities, it would still be invaluable in the formation of many surgical instruments, particularly as a substitute for caoutchouc in many of the articles made of that substance, as I had found that those instruments which had been made of caoutchouc, which had been dissolved in naphtha, or other solvent, became speedily damaged, and totally useless in the damp and hot climate within the tropics. I therefore wrote to the Medical Board in Calcutta, strongly recommending its adoption, and sent specimens of the substance. After having examined it, the board highly approved of my suggestion, and directed me to procure and send some of it to Calcutta, which was done.

I also addressed a communication to the secretary of the Society of Arts, London, and sent some of the substance for investigation and analysis, for which, after my return to England, I had the honour to receive the society's gold medal.

*Mechanics' Magazine.

Being in bad health at the time the substance was brought under my observation, I was unable to prosecute the inquiry in the way I could have wished, not being able to go in person to the forest, and was therefore obliged to satisfy myself with such information as the natives could give me. I ascertained, however, that the tree producing it is one of the largest of the forest, growing to the size of three or four feet in diameter; that the wood is of no value as timber, but that an edible concrete oil is procurable from the fruit, and often used by the natives with their food.

On extending my inquiries, I found the substance was quite unknown to the people at Malacca, although that place is only about a degree to the north of Singapore, and was told that the natives of the island of Sumatra did not know it, although at first I was inclined to suppose that the substance might have obtained its name from that island, the Malayan name for the island of Sumatra being "Pulo Percha."

I ascertained, however, that the tree was common in many places in the island of Singapore, and also in the forests of Johore, at the extremity of the Malayan peninsula; and was informed by the Buggese traders that it grew at Coti, on the south-eastern coast of the island of Borneo; and on requesting Mr. Brook to inquire about it at Sarawak, on the west coast, was informed by that gentleman that it was found in the forests there also.

The following is a quotation from Mr. Brook's communication to me:—"The tree is called 'Niato' by the Sarawak people, but they are not acquainted with the properties of the sap; it attains a considerable size, even as large as six feet diameter; is plentiful in Sarawak, and most probably all over the island of Borneo."

I have reason to believe also that it is abundant on the thousand islands that cluster to the south of the straits of Singapore.

That it is very abundant is satisfactorily proved from the circumstance of its being now collected at Singapore to the extent of some hundreds of tons annually, although unknown to the public in 1842. But although the tree is at present sufficiently plentiful, yet the substance, I fear, will become soon more difficult to be procured from the destructive mode pursued by the natives in obtaining it.

A magnificent tree of fifty, or more probably, 100 years' growth is cut down, the bark stripped off, and the milky juice collected and poured into a trough formed by the hollow stem of the plantain leaf; it quickly coagulates on exposure to the air; but from one tree I was told that not more than 20 lbs. or 30 lbs. are procured.

I believe, however, that the juice may be obtained by tapping the tree, and that it might thus be made to produce in moderate quantities for many years; but this mode is too slow for the natives. Besides, although the first discoverer of a tree might be inclined to do so, the next who found it would, probably, cut it down, there being no property in the trees of the forest excepting where grants of land have been given.

Allow me, now, to correct an erroneous mode of pronouncing the name which I have observed used by many gentlemen with whom I have conversed on the subject. The name is a pure Malayan one, "gutta," meaning the gum or concrete juice of a plant, and "percha" the particular tree from which this is procured. The *ch* is not pronounced hard like *k*, but like the *ch* in the English name of the fish perch. Had I thought there was a probability of the name being mispronounced, I might have used the uncouth orthography pertsha, but it would have run the risk of being taken for a Russian or Polish name. Some of your readers may think I place too much value in a name; but in these days, when public attention is beginning to be attracted to the affairs of the "farther east," and the spirit of enterprise is leading many of our countrymen to explore those interesting regions, if one of them were to inquire of a Malay for "*gutta perka*," he would be told the thing was unknown, when perhaps plenty of the gutta percha might be procurable by pronouncing the name properly.

Among the various uses to which it has been proposed to apply the gutta percha, I have observed some for which its properties render it peculiarly applicable, and one in particular, printing for the blind, for which the clear sharp impression it receives, and the toughness of the substance, admirably suit it, as well as in the formation of embossed maps for that unfortunate class.

As an application of it of minor importance certainly, but one of very general usefulness, it has been suggested to me that it would be found useful in stopping decayed teeth.

A MEANS OF PREVENTING SEA-SICKNESS.

BY M. JOBARD.

"When, being either seated or standing, we find ourselves rise and sink, it is always," says M. Jobard, "while sinking, and never while rising, that the crisis is felt. From

this, I conclude, that the effect is caused by the raising of the mass of the intestines, which having a considerable degree of mobility, press upon the diaphragm, and excite the action of vomiting. At the same time, there is a compression of the liver, and the gall-bladder empties its contents into the intestines; which, by an antiperistaltic motion, force the bile into the stomach, that soon ejects it. During the opposite motion of the ship, the intestines press against the basin of the pelvis, and become more distant from the diaphragm. What we ought, therefore to endeavour to effect, to avoid sea-sickness, is to prevent the motion of the mass of the intestines against the upper part of the abdomen, and for that purpose it will be sufficient to restrain its movement by means of a belt placed beneath the thorax. Experiment has shown me that, in order that this belt may produce the best effect, it ought to be so placed that the stomach may not be included within the sphere of its compression.

REPORT MADE BY M. SILVESTRE, JUN., IN THE NAME OF THE COMMITTEE OF ECONOMICAL ARTS, ON MR. GOUBAUD'S APPARATUS FOR MAKING ICE.*

Up to the year 1845, not one of the processes proposed for producing artificial ice, by means of refrigerating mixtures, had been usefully employed for domestic purposes. The Society for Encouragement, therefore, taking into consideration the numerous advantages offered by the great improvements made in scientific researches, thought fit at that period again to call the attention of the public to this interesting question, and proposed a prize for the best apparatus.

As the end to be obtained was to furnish families with the means of producing ice in localities where it could not be easily procured in the natural state, it was deemed necessary to prohibit the employment of pounded ice, and also of any substance, the use of which might be attended with danger in inexperienced hands.

Several persons have endeavoured to obtain the result required, but only one has complied with the directions of the Society. The refrigerating apparatus submitted to your judgment by M. Goubaud, and which you have referred to the Committee of Economical Arts, has for its object the production of ice from water, without employing pounded ice, or any substance in using which danger is to be apprehended.

The result stated by the inventor to have been attained appeared so satisfactory to your committee, that, without delay, they examined the apparatus in question, and made the experiments necessary to enable them to test its advantages.

You have already seen, at a recent meeting, that M. Goubaud's refrigerator is very simple, both in its construction and mode of working, and that by means of a mixture of salts and water it produces ice in a short time, and in sufficient quantities for domestic purposes. In addition to this it may be as well to state, that the salts necessary for producing the frigerific mixture may be anywhere readily procured, and that the substances employed may be intrusted, without danger, to the most inexperienced person.

It therefore only remains to ascertain whether the cost of the ice, as stated by the inventor, had been calculated with reference to processes simple and capable of being carried into effect by any party; or whether it was not (as is frequently the case) the result of certain delicate chemical operations.

The refrigerator, which has been referred to the Committee of Economical Arts, is an apparatus of convenient size, composed of twelve tubes; for the operation, about 2,500 grammes of salts and five pints of common water, at a temperature of about 12 degrees, are required; by means of which about 500 grammes of water are congealed, at the same temperature, by a single operation, which lasts from fifteen to eighteen minutes.

Several experiments were made by your committee with this apparatus, not strictly according to the rules of science, but with all the care which it is possible to give to these kind of operations.

The following were the average results obtained:—Loss upon the whole of the salt, after each experiment, 24 grammes, or 9·6 grammes per kilogramme; and in value 8·4 centimes for the whole, or 3·4 centimes per kilogramme.

With regard to the expense occasioned by the revivification of the saline mixture, very great precautions were taken by the committee for ascertaining this expense.* The quantity of charcoal employed in the evaporation of the saline liquor has been found to average 1,270 grammes, worth about 19 centimes.†

* *Newton's London Journal.*

* It must be remembered that the revivification of the salts takes place after each operation.

† In Paris, charcoal is sold at an average price of 15 centimes.

If it be supposed that the refrigerator lasts ten years, and is worked on an average five times per week during five months, the purchasing price being 38f., the loss occasioned by the use of the apparatus, including the interest of the capital engaged in the purchase, is about 5 centimes each operation.

The cost of the 500 grammes of ice is therefore, in Paris, 32 centimes, or 64 centimes per kilogramme.*

I must, however, say, that a considerable diminution in the expense of combustible will be obtained—1st. If instead of revivifying after each operation, a sufficient provision of salt is made to submit larger quantities of the solution to evaporation, as, for example, from 6 to 8 gallons. 2ndly. When, instead of employing wood-charcoal, a less expensive combustible is used. 3rdly. When a portion of the caloric lost in working is employed in concentrating the solutions. 4thly. If the heat of the sun be employed for the concentration and crystallisation. Lastly. If a furnace be employed, constructed in such a manner as to expose the whole superficies of the boiler to the direct action of the fire-place; which arrangement will be the more advantageous, as the liquid to be evaporated is, of all saline solutions, that requiring the most caloric to attain the boiling point.

It cannot be denied, that by employing, at the same time, if possible, the easy means of evaporation just mentioned, a great diminution in the cost of fuel might be effected.

On the other hand, the salts which M. Goubaud employs, and which are sold at about 1s. 6d. per lb., will necessarily diminish in value immediately it becomes necessary to manufacture on a large scale, which is already being done.

It appeared to your committee that the price of the refrigerator was rather too high; and it will no doubt be possible to reduce the cost considerably. At any rate, several advantageous modifications may be made without increasing the price.

From the foregoing, the Committee of Economical Arts estimates the cost price of the ice, per lb., may be very reasonably estimated at 38 centimes, as stated by the inventor, and even as low as 30 centimes, required by the Society. It is therefore to be desired, that from the present time up to the period when the Society shall close its discussions on the subject of refrigerating apparatus, M. Goubaud would exert himself to furnish precise information on the means by which the public may easily obtain ice at the terms imposed by the programme. The committee is therefore of opinion that M. Goubaud's apparatus may from this time render essential service in domestic economy, and that a very advantageous use may be made of it, under certain circumstances, for medical purposes.

* This cost price, calculated in Paris, where fuel is dear, may be considered as the maximum price. Besides, M. Goubaud manufactures his apparatus less for Paris and the large towns, where ice is very cheap, than for the numerous localities where it is not to be procured without great difficulty, and where, in order to effect the revivification of the salts, very easy and cheap means are used.

AN INQUIRY INTO THE MODE OF PROCEDURE IN CASES OF POISONING BY PERCHLORIDE OF MERCURY.*

Poisonings by chloride of mercury offer a difficulty, from the fact of this poison, when in a solid state, combining with fibrin, albumen, and the other solid elements of bodies, and from its being insoluble under that form. M. Clamor Marquart had occasion to make some experiments on the recent corpse of a man who, according to his own account, had taken an ounce of corrosive sublimate. No trace of the sublimate was found in the liquid contents of the stomach; but, by means of hydrochloric acid and hypochlorite of calcium, we were able to obtain a few traces of mercury from mucous matters insoluble in water: by cutting in pieces the membranes of the stomach, and submitting them to the same treatment, we obtained a clear solution, in which sulphuretted hydrogen produced an abundant precipitate of sulphuret of mercury, by means of which we satisfied ourselves of the presence of mercury by all its characteristic reactions.

This mode of operating, however, never leads to a very certain result, for the question is not to discover mercury, but chloride of mercury, for the mucous portion of the stomach may contain chlorate of mercury, the presence of which is, perhaps, due to a perfectly innocent cause, having no reference to the death of the individual.

In the present instance, and supposing the deceased man had not acknowledged poisoning himself with the sublimate, it would have been of the highest importance to extract the mercury from the membranes of the stomach after having well washed them, for the sublimate was combined with them, while the

* *Journal de Chimie.*

chloride had not entered into combination with these membranes.

It is necessary, therefore, to remove all doubt in medico-legal experiments of this nature, to discover a method, by means of which we could extract the sublimate from its animal combination by means of ether or concentrated chloride or iodide of potash, or other bodies possessing sufficient affinity to separate it from all the pieces; for in this manner it will be evident that the mercury would be discovered in the state of a chloride of mercury, and not a chlorate.

To discover the presence of mercury in the state of solution which results from the preceding operation, M. Frampton recommends the allowing the solution to digest along with silver powder, prepared by the reduction of chloride of silver by means of zinc, or by a ley of potash and sugar. A chloride and an amalgam of silver are formed, from which the mercury can be separated and obtained in a metallic state by heating it in a bent tube, closed at one end.

EFFECTS OF ALCOHOL ON THE ANIMAL FRAME.*

When alcohol is introduced into the circulation, its elements combine with the oxygen of arterial blood; and the globules, becoming thereby deprived of this vivifying principle, no longer assume a florid red colour. The animal becomes asphyxiated; and if the quantity of alcohol be large, it dies as speedily as if it had been plunged into an atmosphere deprived of oxygen. Carnivorous animals, as the dog, which has a large stomach compared with the rest of the alimentary canal, are very easily affected by alcohol, and may be destroyed by a moderate dose; for the liquid is rapidly absorbed, and is not carried beyond the duodenum. Herbivorous rodentia, as rabbits, are, in like manner, easily killed by small quantities of alcohol. Absorption takes place rapidly in the stomach, and alcohol is not found in the intestines. Graminivorous birds, such as chickens, will bear comparatively larger doses of alcohol. The inner cavity of their stomachs is of limited extent, and the organ itself is formed of powerful muscles. When alcohol is ingested, it is soon expelled from this cavity, and is found in the intestines; it is thence carried to the liver by the vena portæ, and only reaches the great mass of the circulation slowly. Fish will live at a temperature of 41 degrees, in water which contains one half-hundredth part of alcohol.

* *Comptes Rendus.*

NOTE ON THE PREPARATION OF SCAMMONY AND ITS EMPLOYMENT.

BY M. WIMMER.

The author recommends the following formula, as offering the greatest advantages:—

℞ Pure scammony resin 3 grammes.
Venice soap ..... 25 centigrammes.
White sugar ..... 275 ,,

Mix, and reduce to fine powder. Then add by degrees—

Powdered biscuit .... 24 grammes.
Water ..... a few drops.

Triturate well, and carefully, to remove the powder that may be attached to the pestle, and then mix with the remainder of the powder.

These powders are afterwards dried in the air, and divided into packets of 30 grammes each.

3 grammes of the powder contains 30 centigrammes of scammony.

The dose is from 40 centigrammes, which is sufficient to produce several stools in the case of an adult. For children of 15 years of age, the dose is reduced to 30 centigrammes, for those of seven or eight years to 20 centigrammes, and finally for children of two years of age to 10 centigrammes.

These powders, in addition to their purgative properties, have the advantage of being an easily administered vermifuge.

THE SALE OF POISONS, AND SHORT HOURS.

The following letter appeared in a recent number of the *Pharmaceutical Times*:—

"As regards the sale of poisons, I may, perhaps, be excused stating the plan I have always adopted as to the sale of arsenic. I invariably (with the exceptions below) refuse it to any single party applying, but always require the presence of a second person, and both known to each other. I, then, in a page (devoted to that purpose) of the day, or some other book lying constantly open upon the desk, enter their names, places of abode, date of sale, quantity supplied, and purposes for which it is said to be required. In any case of inquiry by police or others, I at once place before them the register so kept. The only exceptions I permit are those cases when a letter is received from persons with whom we are acquainted, by a second party, to whom its purport is explained, and, if the poison is supplied, whose name and address, as well as the letter, is registered as before stated.

"I do not think, however, that by the

entire prohibition of the retail sale of arsenic, the public would, in any degree, be injured. As to oxalic acid, opium, laudanum, and some other poisonous articles, I do not see how they could be interfered with. The first is in almost daily use by bonnet-makers and others; and the latter, in many districts, as commonly asked for and sold as other drugs. The only precaution I adopt as concerns them is to ask the parties applying if they know the proper dose, to caution them as to their indiscriminate use, and properly label them "Poison." I do not wish to appear in print; but if the plan now given, and which I do not recollect to have seen before published, will be of any use in any future article you may write upon this subject, my purpose is fully answered.

"I might also add that I presided at a meeting of the druggists of this borough, last evening, for the purpose of endeavouring to effect an unanimous arrangement as to the earlier closing of our respective establishments, and seven-ninths were in favour of the change. I hope yet to see it carried out."

Dudley, Nov. 3.

IV. REVIEWS AND NOTICES OF BOOKS, &c.

CONSUMPTION; ITS SYMPTOMS AND TREATMENT. By Geo. Moore. London: Henry Renshaw.

This little work has been published with the intention of giving the public a clearer notion of the real nature of consumption, and the means of distinguishing it from other diseases to which its outward symptoms bear a strong affinity.

The author is one of those who consider this fearful disorder capable of cure; and he quotes, as his authorities, Abernethy and Laennec. The system on which he relies, when endeavouring to restore his patient, he calls "Antiseptic." This system he describes in his work, together with his own experience on the subject, and his apparently successful practice. For these particulars, we refer our readers to the book itself.

ELEMENTS OF CHEMISTRY; INCLUDING THE APPLICATION OF THE SCIENCE IN THE ARTS. By Thomas Graham, F.R.S.L. and E., &c. Second edition, entirely revised and greatly enlarged, with additional wood engravings. London: H. Baillière. Part I.

The last edition of "Graham's Elements of Chemistry," was published in 1842, and the demand for another issue of a work of such magnitude, is a proof, not only of the high estimation in which the book is held, but also of the rapidly increasing progress of the science on which it treats.

This new edition, as far as we can judge from the first part, has been very much enlarged and improved. One particular feature of the book, is the extension of the tables on the contraction of liquids from the boiling point downwards; the specific heat of solids, liquids and gases; the production of artificial cold, &c. There are, also, in the present part, several new tables, among which we find the following, which is of considerable utility for practical purposes:—

Name of substance.	Conducting powers referred to that of slate—100.
Plaster and sand	18·70
Keene's cement	19·01
Plaster of Paris	20·26
Roman cement	20·88
Beech wood	22·45
Lath and plaster	25·55
Fir wood	27·61
Oak wood	33·66
Asphalt	45·19
Chalk (soft)	56·38
Napoleon marble	58·27
Stock brick.....	60·14
Bath stone	61·08
Fire brick	61·70
Painswick stone (H.P.) ...	71·36
Malm brick	78·92
Portland stone	75·10
Lunelle marble	75·41
Bolsover stone (H.P.) ...	76·35
Norfal stone (H.P.)	95·36
Slate	100·00
Yorkshire flag	110·94
Lead	521·34

The work being judiciously published in parts, is rendered accessible to almost every chemical student.

MISCELLANEA.

DEATH OF MR. MARSH, THE INVENTOR OF THE APPARATUS FOR TESTING THE PRESENCE OF ARSENIC.

In noticing the melancholy death of one of our earliest and most valued correspondents, and the refusal, by Government, of assistance to his widow, we cannot avoid painfully feeling the neglected position in which all those who devote their lives to tracing the intricate mazes of science are placed by the rulers of a great country.

The value of Marsh's invention can hardly be fully appreciated by those who have not noticed the great services it has rendered to medical jurisprudence; but the rewards and distinctions bestowed by states seldom fall to the share of the labourers in the field of science, and yet such men have deserved more gratitude from their fellow-creatures than the bravest leader of an army, or the greatest hero that ever trod a quarter-deck. We extract the following paragraph on this subject from the *Daily News*, and earnestly hope the intention therein alluded to will be successfully carried out:—

"The late Mr. Marsh.—We have received the following suggestion for the benefit of the widow of this eminent but ill-paid chemist:—'Dr. May, of Rathfriland, suggests most respectfully that a European sixpenny collection, in aid of the widow and family of the late chemist, Marsh, of arsenical test notoriety, should be at once set on foot. What would be better than every medical man, every chemist, every philanthropist forwarding his six postage stamps to a person that will be kind enough to receive the same, and a committee to consult what would be the best use to convert the sum into, for the aid of the widow and family? Who, after reading his various papers, would for a moment think of delaying a plan for the relief of all that was dear to departed worth and neglected talent?' Our correspondent will be glad to learn that a public subscription for the widow and family of this distinguished chemist has been originated at Woolwich, to increase the pittance of 20*l.* voted by the Board of Ordnance to Mrs. Marsh. The Woolwich Consumers' Gas Company, of which Mr. Marsh was the superintendent, have granted the sum of 20*l.*, and Mr. Barlow has contributed 21*l.*, and it is expected that in a short time a sum will be raised sufficient to place the family above the immediate reach of want. Memorials have been forwarded to the various learned societies with which he was connected, the Royal Society of Arts (amongst others) having voted Mr. Marsh their silver medal for his test for the detecting of minute quantities of arsenic."

GUN SAWDUST.

Mr. George Turner, a Leeds correspondent of the *Athenæum*, writes:—"The results of my experiments on gun-cotton may be comprised in the discovery of a cheaper, but equally explosive, compound, in common sawdust, and, indeed, in all woody fibrous vegetable material, by immersion from eight to ten minutes in equal measures of nitric acid, specific gravity 1·5, and of common oil of vitriol. A slight increase of the latter increases the rapidity of combustion. I here enclose you a specimen of prepared common sawdust, with which I have discharged a pocket pistol, loaded with ball, with a force equal to that of gunpowder; indeed, I should say, weight for weight, it will prove the better projectile. I wish you to try yourself with the specimen enclosed. Put it into a pistol—making sure that it is in the breech of the pistol—place on the nipple the percussion cap, and you will find, on discharging it, that the force is equal to that of an equal weight of gunpowder."

ON THE OLFACTORY POWERS OF THE TURKEY-BUZZARD.*

BY N. MENDENHALL, M.D.

In reference to the sense by which the turkey-buzzard is guided in the search of its food, the experiments of Audubon, &c., would appear to be conclusive, inasmuch as they seem to prove that this bird is not guided by the sense of smell, but that it is led by the sense of sight only. I am not aware of the precise circumstances under which these experiments were conducted, yet, from facts which are known to myself, I cannot but infer that there must be some fallacy in the conclusions to which they lead.

* *American Medical Examiner.*

It is a very common practice in our part of the Union, when any animal dies, to drag it into some deep ravine in the neighbourhood, and there let it putrify and be devoured by the buzzards. These ravines or hollows are generally surrounded by bushes and trees of a very luxuriant growth, and notwithstanding the foliage is so thick that the rays of the sun cannot penetrate it, thus rendering it in the highest degree improbable that anything under them could be distinguished by a bird in the air, yet we find the dead animal surrounded by buzzards—so far as I know, never before, but as soon as it begins to emit a perceptible odour.

I could relate instances, too, of snakes and other small animals being killed and thrown out into a thicket of bushes and weeds so dense as to render any small object invisible at the distance of two or three feet; yet, whenever the smell of putridity became marked, these vultures were attracted to it in considerable numbers. What makes me more certain that they were led to it by the sense of smell only is the fact that, when they arrived within a short distance of the dead animal, they would alight and look about, and, not finding it, make shorter and shorter gyrations, until, seemingly, led on by a stronger and stronger scent, they reached the spot where they could gratify both their sight and taste.

The arguments given above, however, are not absolutely conclusive, for it may be said that we are not positively certain that the buzzard was not here directed by the sense of sight, though this is in a very high degree improbable; and I will therefore give another instance on the authority of my roommate (E. B. Clark), which, it seems to me, added to the circumstances before mentioned, and others of a similar kind, ought to put this matter at rest. A number of swine, and among them a brood of little pigs, were in the habit of lying under an old barn. The barn had in a good measure lost its roof, but the floor of the part under which the swine slept was complete, and, moreover, piled up with boards, &c., so as to render it impossible that anything could be seen from above; and it was raised only about eighteen inches from the ground. One of the pigs died in this situation. Some short time after the workmen were engaged in hauling hay by this barn, and seeing a good many buzzards perched on a fence near it, which returned after being frightened away, and, on coming still nearer, perceiving the smell themselves, they were led to inquire into the source of it. After considerable search the dead pig was found far under the floor—so far, that in this instance there can be no doubt that the buzzards were attracted towards it by some other sense than that of vision.

Nor do I think that the observation of the English professor (Owen), alluded to by you, is of small weight in determining this question, not saying, by-the-way, that the question itself is of any great importance. I believe it is a principle very generally conceded, that the amount of sensibility in any part is in direct proportion to the amount of nervous matter distributed to that part, at least when the nerves are in a state of health. When, then, we consider the beautiful uniformity which prevails in the works of creation, and at the same time recollect that the Almighty architect formeth nothing in vain, we cannot but conclude that whatever the observation of Audubon, &c., may have shown in respect of the vision of the bird alluded to, its sense of smell is in a high degree acute, and that frequently it is guided by this alone.

In relation to this subject may be cited the following remarks of the distinguished naturalist, Mr. Charles Darwin, M.A., F.R.S., in his "Journal of Researches into the Natural History and Geology of Countries Visited During the Voyage of H.M.S. Beagle Round the World":—"When an animal is killed in the country (Chile), it is well known that the condors, like other carrion vultures, soon gained intelligence of it, and congregate in an inexplicable manner. In most cases it must not be overlooked that the birds have discovered their prey and have picked the skeleton clean before the flesh is in the least degree tainted. Remembering the experiments of M. Audubon on the contracted smelling powers of carrion-hawks, I tried, in an enclosed garden, the following experiment. The condors were tied, each by a rope, in a long row at the bottom of a wall; and having folded up a piece of meat in white paper, I walked backwards and forwards, carrying it in my hand at the distance of about three yards from them, but no notice whatever was taken. I then threw it on the ground, within one yard of an old male bird; he looked at it for a moment with attention, but then regarded it no more. With a stick I pushed it closer and closer, until at last he touched it with his beak: the paper was then instantly torn off with fury, and at the same moment every bird in the long row began struggling and flapping its wings. Under the same circumstances it would have been quite impossible to have deceived a dog. The evidence in favour of and against the acute smelling powers of carrion-vultures is singularly balanced. Professor Owen has demonstrated that the olfactory nerves of the

turkey-buzzard (Cathartes aura) are highly developed, and, on the evening when Mr. Owen's paper was read at the Zoological Society, it was mentioned by a gentleman that he had seen the carrion-hawks in the West Indies, on two occasions, collect on the roof of a house where a corpse had become offensive from not having been buried: in this case the intelligence could hardly have been acquired by sight. On the other hand, besides the experiments of Audubon and that one by myself, Mr. Bachman has tried in the United States many varied plans, showing that neither the turkey-buzzard (the species dissected by Professor Owen) nor the gallinazo find their food by smell. He covered portions of highly offensive offal with a thin canvas cloth, and strewed pieces of meat on it: these the carrion-vultures ate up, and then remained quietly standing, with their beaks within the eighth of an inch of the putrid mass, without discovering it. A small rent was made in the canvas, and the offal was immediately discovered; the canvas was replaced by a fresh piece, and meat again put on it, and was again devoured by the vultures without their discovering the hidden mass on which they were trampling. These facts are attested by the signatures of six gentlemen, besides that of Mr. Bachman."

CHEMICAL SOCIETY OF LONDON.*

The members of this society held their first meeting this session, at their rooms, John-street, Adelphi, on Monday evening, the 2d instant. T. Graham, Esq., president, in the chair.

An analysis of a Peruvian alloy was communicated by Mr. H. Howe, as illustrative of the state of the science of alloying, at the era to which it belonged.

Mr. Teschemacher read a paper on gun-cotton. He states that he was induced to enter into the examination of the synthetical composition and formation of gun-cotton, with a view of obtaining some data by which an opinion could be formed how far the possible introduction of this substance, in the place of gunpowder, was likely to affect the production and consumption of saltpetre and and nitrate of soda. The gun-cotton examined was made by Mr. Taylor's process of mixed acids, and the experiments are, therefore, entirely confined to such gun-cotton.

Mr. Teschemacher dried fifty grains of South American cotton over a water-bath, and found it lost 3·40 grains, being hygrometric water. The remaining 46·60 grains were steeped in the mixed acids, washed, dried, and weighed, and found to have increased to 79 grains.

The acids used were then examined, and it was found that the sulphuric acid was not at all diminished in quantity. By saturating the acids used with carbonate of soda, it was found that the cotton had taken up, or saturated, equal to 28½ grains of soda, equivalent to 48 grains of dry nitric acid, the quantity which had combined with the 46·60 grains of cotton, forming the 79 grains of gun-cotton. The synthetical composition was then stated as—

46·60	parts	cotton, less
15·60	,,	water, taken away by the sulphuric and nitric acid, leaving
31·	,,	cotton deprived of a portion of its constitution—water.
35·55	,,	oxygen } equal to 48 parts dry
12·45	,,	nitrogen } nitric acid.
79·	,,	or,
39·25		cotton, deprived of a portion of water.
45·		oxygen.
15·75		nitrogen.
100	parts.	

From these experiments it was shown that it would require 114·75 parts of saltpetre, or 99·10 parts of nitrate of soda to form 100 parts of gun-cotton.

Mr. Teschemacher repeated that his experiments related only to such gun-cotton as was made by Mr. Taylor's process; but, at the same time, directed attention to the large quantity of oxygen, viz., 45 parts in every 100, which must be derived from some extraneous source, for combination with the cotton. In conclusion, he stated, that he had made experiments also upon the combination of nitric acid in a similar manner with other vegetable substances, such as flax, sawdust, &c.; he found that 50 grains of flax increased in weight to 72, but that the combustion of the substances was less perfect and less rapid than that of gun-cotton.

Mr. Teschemacher could not give any idea of the relative strength of gunpowder and gun-cotton, as that was a subject which still remains to be examined.

Mr. Taylor, on being called on, stated, as his opinion, that the degree of its explosive force lay between those of fulminating mercury and gunpowder. The suddenness of its explosion, he considered to be unfavourable to its use as a projectile agent, compared with the slower action of gunpowder. Nitric acid was liable to be too rapidly dis-

* *Pharm. Times.*

engaged, which was another disadvantage in its use, and it was observed, that when the cotton was pressed very tight the whole was not consumed.

Mr. Warrington stated, that experiments had been made under the direction of the Hon. the East India Company at their depôt, which had shown considerable superiority of the cotton to gunpowder.

Mr. Taylor invited the attention of the society to the remarkable fact, that, in explosion, the fibrous structure of the cotton remains unchanged, except as being rather harsher to the touch—a fact from the investigation of which new results might be expected. At the close of this discussion the meeting broke up.

THE SOLUBILITY OF LEAD IN ALL WATER CONTAINING FREE CARBONIC ACID.*

Previous to the year 1757, A.D., lead-colic was very rarely met with in Amsterdam. Soon after, however, the citizens began to substitute lead for tiles on the roofs of their dwelling-houses, and the disease broke out with violence, and committed great ravages. Dr. Frouchin very properly ascribed its increase to lead entering the body insidiously along with the water, which he inferred had acquired the power of corroding the lead by having become acid (impregnated with carbonic acid gas) in consequence of the roofs having been covered with decaying leaves from the trees which abounded in the city; and without a doubt this explanation accords with the season at which the lead-colic was observed to be most frequent—namely, the autumn. Sir G. Baker, in a letter to Dr. Heberden, has related another striking instance. Lord Ashburnham's house, in Sussex, was supplied from some distance with water, which was conveyed in leaden pipes. The servants being often affected with colic, which had even proved fatal to some of them, the water was carefully examined, and found to contain lead. The solvent power of the water was ascribed, very properly, to its containing an unusual quantity of carbonic acid gas.

THE EARL OF ROSSE'S TELESCOPE.†

When Dr. (afterwards Sir William) Herschel completed his gigantic speculum, it was supposed that the reflecting telescope had received the highest power of which it was susceptible; this great astronomer, having formed and applied a speculum four feet in diameter and forty feet in focal length to a telescope of the Newtonian kind, was rewarded on the night after it was finished by the discovery of the sixth satellite of Saturn. The Earl of Rosse, however, with a zeal which sets a bright example to his fellow-noblemen, and a genius which duly appreciates the advantages to be derived from wealth and station to philosophical investigation, has successfully completed the construction of an instrument the attempt at which, when first proposed, was deemed little short of a chimera. This scientific and persevering nobleman has put the test of practicability to an idea devised by himself, and his labours in the result have met with the most complete success. The expense incurred in the completion and erection of this enormous telescope has, we believe, very considerably exceeded 12,000*l*. The speculum, composed of copper and tin united in the proportions of copper 126·4 parts, tin 58·9 parts (very nearly in their atomic proportions), was cast in a foundry erected expressly for that particular purpose. The crucibles, formed of cast iron, each two feet in diameter, two and a half feet deep, and weighing together one ton and a half, were three in number, and made to fit into the same number of iron baskets supported on pivots and hung around the mould. To each of these baskets was attached a lever, by means of which they could simultaneously be depressed and the contents of all the crucibles poured into the mould. Contiguous to the furnace was the annealing oven. The speculum was cast on the 13th of April, 1842, between nine and ten o'clock in the evening, and, after being exposed to the heat and gradual cooling of the annealing oven for sixteen weeks, was removed to the grinding machine in as perfect a state as when it entered it; the process of grinding was conducted under water, the motive power being a steam-engine of three-horse power. The polisher, moved by the same machinery, was connected to it by means of a ring of iron, which loosely surrounded it; and, instead of either the speculum or the polisher being stationary, both were contrived to move with a regulated speed. The material employed to wear down the surface was emery and water, a constant supply of which was kept between the grinder and speculum. This operation, which lasted six weeks, together with the casting and polishing, were all completed under the personal superintendence of Lord Rosse, and, by means of his untiring energy and skill, without the occurrence of

* Christison on Poisons.

† *Magazine of Science.*

any accident. The telescope, as now completed, consists of a tube of deal one inch thick, and hooped with iron, of the enormous length of fifty-six feet, including the speculum-box. On the inside, eight feet apart, are placed rings of iron of substantial thickness, for the purpose of strengthening the sides. The tube, seven feet in diameter, is fastened to stout masonwork in the ground, so contrived as to permit its free motion in every direction. Immediately in the meridional line, on either side of the telescope, are built two walls seventy-two feet long, forty-eight high on the outer side, and fifty-six on the inner, and twenty-four feet asunder, the tube being twelve feet distant from each wall; between these two walls is placed the machinery for adjusting the movements of the tube, which, when directed southerly, may be depressed till almost on a level with the horison; but, when directed to the north, the arrangements preclude its motion further in that direction than in a position parallel to the earth's axis, that is to say, pointing to the pole of the heavens; its movements, laterally, are confined by the walls to a view comprising fifteen degrees.

GUN-COTTON; ITS MANUFACTURE, ADVANTAGES AND DISADVANTAGES.

The following are the results of a series of experiments undertaken at Paris by order of Government, and communicated to the Academy of Sciences:—

With respect to the manufacture, it is necessary, in order to obtain a satisfactory result—

1. To steep clean cotton in a mixture, composed of equal parts of nitric and sulphuric acids.

2. The length of time it is immersed appears to be of little moment; the best specimens were those which had been steeped for from 10 to 15 minutes.

3. We may employ a mixture, in which cotton has already been immersed, by reviving it, if necessary.

4. The cotton must not be above the level of the liquid.

5. It is necessary to dry the cotton slowly, and to avoid submitting it to a temperature exceeding 212° F., especially while still moist.

6. Its energy is somewhat increased by washing it in water saturated with saltpetre, but it is scarcely worth the extra expense.

With respect to its use, gun-cotton possesses both advantages and disadvantages.

The advantages are, cleanliness, rapid combustion, without a solid residue, the absence of a bad smell, its lightness, being able to handle it without danger, of course at a distance from the fire, no possible dust or siftings, an incontestible power, which at present may be calculated at triple the force of an equal weight of gunpowder.

Its disadvantages are, its volume, and, consequently, the difficulty of preparing it, and transporting it as a munition of war; the production of a great quantity of watery vapours in the fire-arms, which is, perhaps, more troublesome while firing, than the incrustation left behind by common powder.

As to the cost price, and the effects of this substance on fire-arms, these are subjects yet to be studied.

What we have already acquired, is the knowledge of a new power, this is incontestible. This power exists, we can produce it; we have still to learn how to utilise it.

There is no doubt we shall succeed in this attempt, and, at the same time, we shall be able to cause some of the disadvantages to vanish, which are at present visible. It is also to be presumed, that when we know better how to proceed, the cost of a substance, which can be manufactured in a loft, will not be alarmingly high.

The experiments are being continued by the ordnance authorities.

REMARKABLE PHENOMENON.

The Hon. Fox Strangways writes home:—"In the immediate neighbourhood of Alexandersbad, near Wansiedel, a few miles south of the road from Bayreuth to Eger, in the Fichbelgebirge, is a mountain, called now the Louisenberg, formerly the Luchsberg, which is much visited by strangers on account of some of its natural curiosities. It appears not to cousist of any mass of rock, *in situ*, but to be an enormous heap of disconnected but rounded fragments of granite, thrown confusedly upon each other, and having arches, passages, and grottoes of various sizes, wherever the interstices have not been piled up with smaller pieces. The whole is overgrown with wood, so that, excepting where paths are made, it is difficult to penetrate. One of the caverns or chambers, formed by a single flat block of granite, resting horizontally as a roof on other masses, is nearly an exact circle of sixty feet English in diameter. Many that penetrate deeper into the rocks are mere crevices, but they present a remarkable phenomenon, which is not observable in the more open ones. This phenomenon consists of a pale but beautiful greenish yellow phosphorescent light, which, as the observer proceeds into

the cave, becomes stronger and stronger, till it can only be compared to hundreds of glow-worms lying close together on the ground; and it is singular that, however strong this light may be, it does not assume the appearance of a sheet, but always seems to lie in spots, though close together. On taking up some of the mould on which this phosphorescence appears to rest, and bringing it to daylight, its own light (as might be expected) is overcome and disappears, nothing being seen in the hand but black earth, a little sand, some minute whitish cryptogamic powder, and a few fronds of a very small filmy moss of a pale transparent green colour. On taking the mould again into the darkness, the light reappears; but so much dimmed, that it appears as if the slightest disturbance had a tendency to dissipate it. The traditions of the country have long pointed at this mountain as the repository of gold and silver and precious stones, and as the abode of evil spirits or Kobolds, who amuse themselves by tantalising credulous mortals with the sight of gems and riches without end, which, when touched, are turned into dross, or vanish from the sight. The explanation given by this phenomenon to such a belief, current among a simple and imaginative people, is evident. The original name of the mountain itself, Luchsberg, *i. e.* Lynxberg, is somewhat expressive of this splendid peculiarity."

AMERICAN ELECTRIC TELEGRAPH.

At a meeting of the French Academy of Sciences, on the 12th of October last, M. Arago read, from a letter of M. Morse, several details respecting the electric telegraph which has been recently established by a private company between New York and Buffalo. The metallic conductors that transmit the electric current without interruption from the ocean to Lake Erie, extend over the space of 507½ English miles, communicating with the stations at Troy, Albany, Utica, Syracuse, Auburn, and Rochester.

There are two circuits, each consisting of a single wire, throughout the whole distance; this wire is of copper, and weighs 100 lbs. per mile; it is insulated from the pillars by means of large glass knobs; with this exception it is unprotected by any kind of varnish or insulating covering. The return of the current takes place by the same wire. A pile is established at each extremity of the line, the intermediate stations merely having a signal apparatus. A dispatch leaving New York is transmitted, at the same time, to all the stations previously noticed. As to the answers this dispatch may require, the necessary measures have been taken to cause them to arrive one after the other in a certain order, so as to avoid, at the same time, confusion and loss of time. One of the wires only has been hitherto employed along the whole line; the other, at present, has its second battery at Utica.

TO ASCERTAIN THE PURITY OF COD-LIVER OIL.

BY M. A. BOUDARD.

If we mix sulphuric acid with pure cod-liver oil, it produces a chesnut-brown colour.

If the oil is adulterated, the same colour is produced, and perhaps of a deeper tint.

Finally, with fish-oil, alone, we produce a brownish-yellow tint

Under these circumstances, I concluded that sulphuric acid did not give sufficiently marked results to enable us to determine the purity of cod-liver oil.

In the case of the pure oil fuming, nitric acid, is poured in drop by drop, is almost instantly surrounded by a reddish aureola, which circumscribes each drop, and in a few seconds becomes of a beautiful rose colour.

If the cod-liver oil has been mixed with its own weight of fish oil, the rose colour is not apparent, but the transparence of the oil is slightly clouded.

With fish oil, alone, nitric acid produces no discolouration, and not the least cloudiness.

[The editor of the *Journal de Chimie Medicale* observes, that having made trial of the above plan, the results appeared to him to be unsatisfactory.]

TO CORRESPONDENTS.

Gun-Cotton.—In the January number of *The Chemist* will appear a complete summary of the history of gun-cotton, containing a full account of the experiments made by order of the French government, and also the result of individual experience. At present, the subject is hardly sufficiently understood to arrive at just conclusions.

Volume VII. will be ready in a few days.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 310, Strand, London." *Communications must be prepaid, and sent before the 15th of each month, Books for Review before the 10th.*

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JUN 3 1918

PEIRCE, PRINTER, 310, STRAND.